Eastman Kodak Company

presents

PROJECTION GUIDELINES

for

REEL PEOPLE

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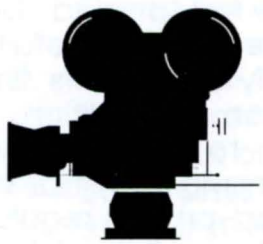


Projection

RECEIVING THE FILM

Every incoming film should be checked upon its arrival at the theatre. There are several different things to look for when the print arrives:

- Is the print the movie title you were expecting?
- Does the print have a sound format compatible with your equipment?
- Do you have the correct number of reels so you have the complete movie?
- Is the aspect ratio (scope or flat) noted?
- When opening the case, do you notice any physical damage to the film?

Films may be received in either the ELR (extended-length reel)-type of shipping cases (typically, two large reels) or the 2,000-foot smaller reel configurations. Each 2,000-foot reel contains approximately 20 minutes of the movie. Make sure you have the proper number of reels and that each of them are different–no duplicates.

Note whether the reels are facing "heads up" or "tails up." You will need to know whether you are starting at the beginning of each reel or you need to rewind it for presentation continuity. For instance, Reel #1 is put onto the platter first, head first; Reel #2 head is spliced onto the tail of Reel #1, and so on.

The condition of each print should be documented at the theatre. After performing a thorough inspection, the following should be noted:

- Feature Title
- Date of Receipt
- Print Number
- Number of Reels Received
- Aspect Ratio
- Sound Format
- Detailed description of any damage to film or shipping cases (maintain an ongoing damage report of anything that may occur during the film's run so that the next theatre does not receive a bad print)

Every film should be inspected carefully manually prior to its first projection. In addition, it is wise to project the entire movie–with trailers attached–prior to regular show times. Scheduling an employee viewing will prevent hidden damage from spoiling your presentation when paying customers are in the auditorium.

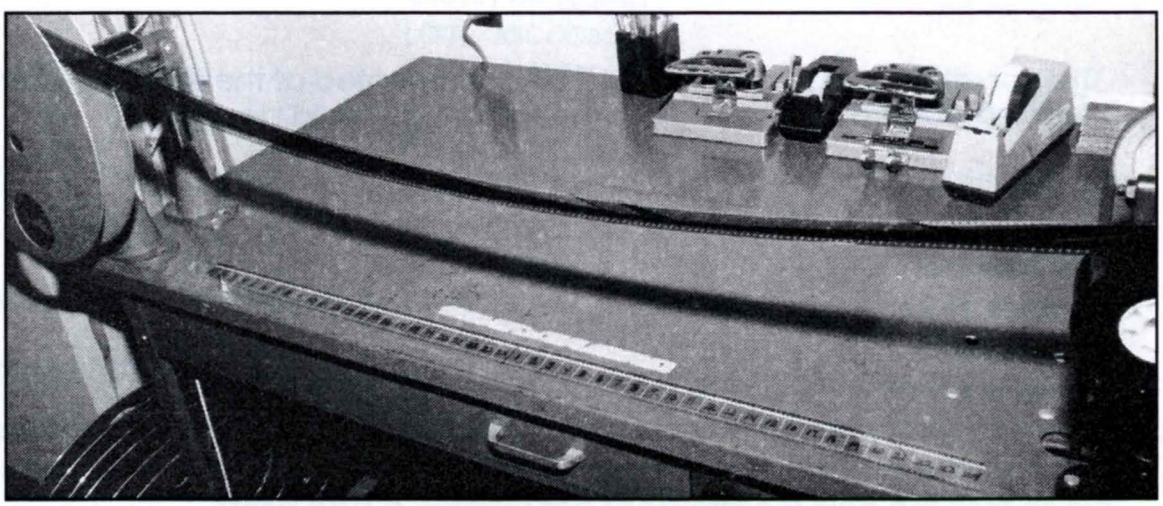
Check the title of the print to make sure it's the movie you are supposed to play.

PRINT INSPECTION

Every time you handle film, be sure to wear lint-free gloves. Skin oils will cause even the cleanest of hands to leave imprints on the film, attracting dirt and dust particles.

Your work area should be perfectly clean. Remember that film is a sensitive, slightly-magnetized medium that will attract dirt or debris from any surface it touches. Dirt on a work bench or rewind table is likely to embed itself in the film as the film's motion increases on a reel. When abrasion results from dirt, the print is permanently damaged and this appears onscreen as unsightly black spots.

NEVER smoke in the projection booth. Nicotine clouds the port glass and optic surfaces and ashes behave like dirt in work areas, embedding themselves in the film's emulsion surface. Maintain as close to a laboratory "clean room" environment as possible in the booth.

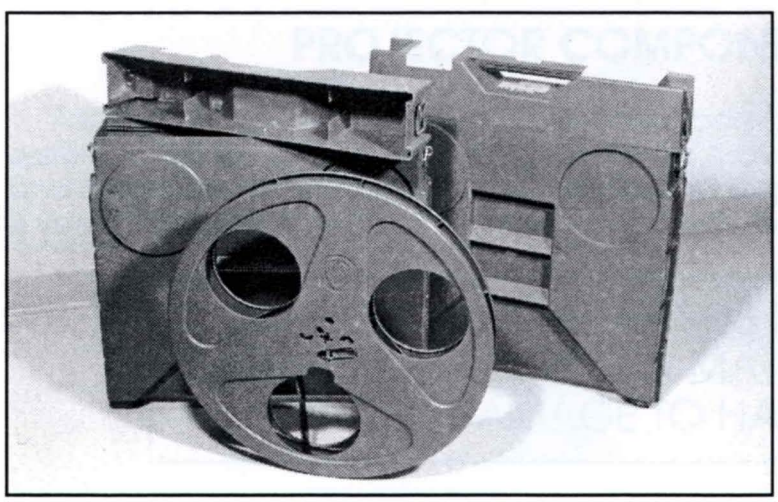


Always keep your work area as clean as possible and free from clutter.

During the film inspection process, pay particular attention to:

- **DIRT** Has dirt accumulated on the film? A speck may seem insignificant to the naked eye, but that small particle is magnified hundreds of times during projection.
- **SCRATCHES** If a print is scratched when it first arrives at your theatre, request a reel replacement. Scratches are not only distracting to the moviegoer, but they also continue to fill with dirt until they are an ugly black line, permanently degrading the film image
- **SPLICES** Poorly-made splices are a primary cause of film damage and program interruption. During your inspection, look for misaligned splices, splices made using cement or anything other than clear tape, and out-of-frame splices. An incorrectly-made splice must be removed and replaced prior to making up the film for platter transport. Bad splices can cause the film to go immediately out of frame during the movie as well as resulting in brain and projector misfeeds.
- **PERFORATION DAMAGE** If the print has never been projected, request a new reel. Most perforation damage, however, occurs during projection when film is threaded incorrectly. Tears and short lengths of film can be removed or repaired with splicing tape. Removing any more than just a few frames could seriously alter story continuity as well as changing time code specifications for digital sound readers. Before projecting, make sure perforation damage is repaired/removed since it can cause program interruptions and equipment failure.
- **EDGE DAMAGE** The primary causes of edge damage are defective film reels, bent spindles, and film that is dry and not supple. It can also be the result of improper reel winding or heavy impact during shipping. Small amounts of edge damage may be repaired with splicing tape to reinforce. If the damage is extensive upon arrival, request a new reel.

PLATTER MAKE-UP



The ELR (extended-length reel) and its shipping case.

The make-up table (MUT) is motorized and moveable so that film goes neatly from core of 2,000-foot shipping reel to core of 6,000-foot build-up reel. The make-up table may then be moved telescoping arm positioned so film goes straight from build-up reel, over roller on arm,

and feeds onto the platter take-up ring. FILM SHOULD NEVER COME INTO CONTACT WITH REEL EDGES OR MAKE SHARP TURNS SO THAT EMULSION IS DAMAGED.

For some ELR (extended-length reel) configurations, it is unnecessary to build up from 2,000 to 6,000-foot reels. The larger reel can simply be positioned on the side mount of the make-up table.

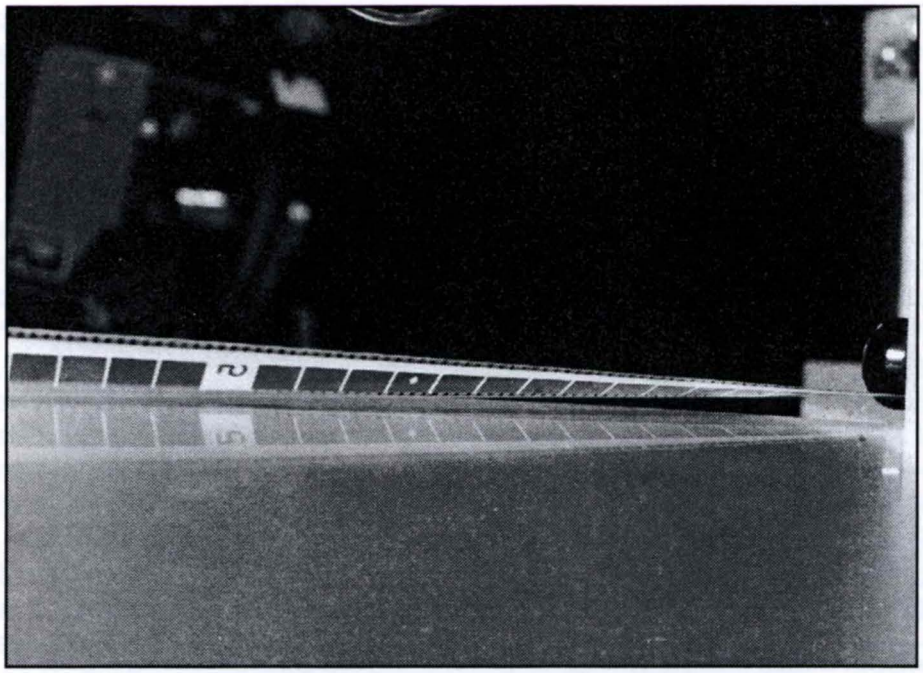
The make-up table is electronically connected to the platter system. Prior to loading the first reel onto the platter, splice approximately fifty feet of clear leader onto the film's head to provide enough material to thread the long film path.

Adjust the rollers on the vertical telescoping pole for optimum alignment with the platter disk. It is VERY important that constant speed is maintained during both build-up and tear-down. Any quick or sudden increases or decreases in speed can cause the film to cinch and scratch.

Place the speed control at its minimum setting, gradually and smoothly increasing the speed. Fasten the film head leader to the take-up ring with the soundtrack facing up, and wind in a counterclockwise direction.

CAUTION: THE POTENTIAL FOR SCRATCHING THE FILM DURING MAKE-UP IS HIGH. Pay particular attention to the following areas:

- **FILM PATH** Film should travel in a smooth, clear path from center of one reel to the next or go directly from center of reel over a roller (watch the edges!) on the telescoping MUT arm to the take-up ring.
- **ROLLER ALIGNMENT** Check alignment of all rollers before starting the platter. The film should be properly seated between the flanges and all rollers should be rotating freely.
- **FILM FEED POSITION** The film should come into very light contact with the platter until it is fastened onto the take-up ring. It should angle down at its edge off the final roller so it barely grazes the platter surface and reaches the take-up ring. Make sure the film does not ride too high on the take-up ring so it "pops" off the center as it winds.



Be sure the film edge is the only area that contacts the platter surface.

STARTING THE SHOW

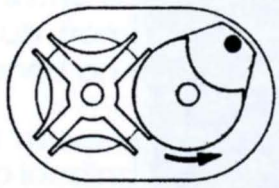
When opening the projection booth at the beginning of the day, access the main circuit breaker for the booth and turn on all booth/auditorium breakers.

At the projector, turn on all breakers for the lamphouse console and automation systems. All breakers should be in the "ON" position. The rectifier circuit breakers control the electrical lines to the power supply. The lamphouse circuit breaker controls power to the lamphouse blowers and control panel. The projector circuit breaker controls power to the projector motor. The automation breaker is for all the automated components. Most projectors are equipped with a convenience outlet that operates off the soundhead breaker.

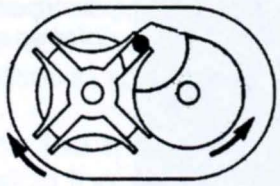
PROJECTOR COMPONENTS

Familiarize yourself with the projector components. The projection system is made up of a motorized system to move the film, a light source and optics for illuminating it evenly, and sound apparatus. It is not complex is you take some time to acquaint yourself with its functions.

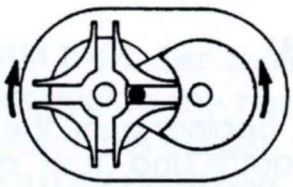
CAUTION: PUTTING HANDS INTO AN OPERATING PROJECTOR MAY RESULT IN SEVERE DAMAGE TO HANDS!



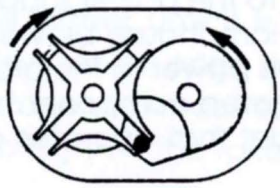
a. dwell (locked up)



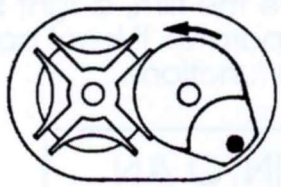
b. start pulldown (acceleration)



c. middle of pulldown (maximum speed)



d. end pulldown (deceleration)



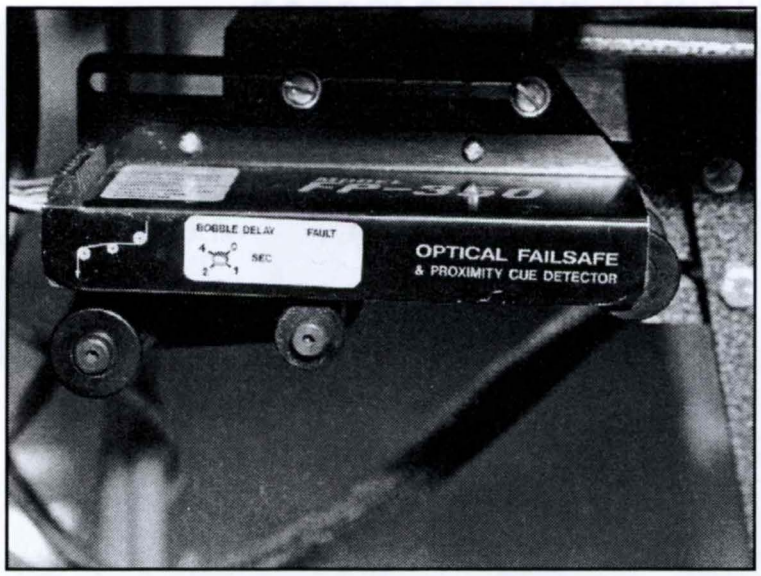
e. dwell (locked up)

The steps of the intermittent motion

- **FILM GATE AND TRAP** The projection trap is a fixed film guiding and locating device. The aperture plate is located in the fixed portion of the trap. The aperture plate opening size varies to allow for different aspect ratios (typically, "flat" and "scope"). The components of the film trap are the LATERAL GUIDES, which hold the film in the correct side-so-side position (weave), and a pair of BANDS against which the emulsion side of the film runs. As the film is running, the gate must be closed. The GATE is the part of the trap that opens to allow for the projector to be threaded. Gate tension has a direct effect on the vertical steadiness (jump) of the projected image.
- **INTERMITTENT ASSEMBLY** The intermittent movement is often considered to be the most complex part of the projector. It serves two functions: to pull the film down one frame at a time to the aperture, and to hold the film in the gate so it is able to be projected. The film enters the fate at 24 frames per second. Each frame must be frozen in the aperture section for the fraction of a second it stops in the gate. It is imperative that the intermittent be properly maintained and lubricated in order for it to function correctly.
- **SHUTTER** During the time that one film frame enters the projector and the previous one is pulled through, the projected light must be interrupted. This function is performed by the shutter. The movement of the shutter and intermittent are synchronized. Unless this is done properly, "travel ghosts" will appear around the images, causing a streaked appearance. The purpose of the shutter is to reduce flicker, making for a smooth flow of the film, simulating motion onscreen from one still frame to the next.

- **FRAMING** A complete frame should be visible in the projector aperture before the movie starts. The FRAMING KNOB vertically corrects possible mis-frames.

- **SPROCKETS** Sprockets and Rollers are used to transport the film through the projector. PAD ROLLERS work in conjunction with the sprockets to keep the film moving along the intended path. The PATH ROLLERS open from the sprockets to allow for threading and cleaning of the machine.



Failsafe and proximity cue detector.

- **FAIL-SAFE** The fail-safe device senses damaged or broken film and stops the projector. The sensing device is located between the optical soundhead and the lower assembly of rollers. If the device is not working, film will pile onto the floor if it breaks as the projector continues running without tension from the platter system.

- **LENS** The lens is responsible for focusing the picture from projector to screen. Most projectors can accommodate more than one lens so that different aspect ratios may be projected. The most commonly used lens combinations are anamorphic ("scope") and "flat". The correct lens for the format should be in place when the image hits the screen. A LENS TURRET permits switching between lenses for scope and flat presentations. For instance, flat trailers might be attached to the head of a scope movie. The particular lens used will depend upon the configuration of the theatre, including screen size and "throw" (the distance from center of aperture to center of screen). Lenses of incorrect focal length for an auditorium can cause serious light deterioration.

- **OPTICAL SOUNDHEAD** The optical soundhead reads the soundtrack from 35mm films. An EXCITER BULB focuses a slit of light onto the soundtrack area of the film. As the film moves, light passes through the soundhead, striking the PHOTOCELL on the SOUND DRUM. This photocell creates variable voltage proportional to the variable light which is amplified, processed, and sent to the speakers as the sound signal. The sound drum is the only component on the projector that should come into contact with the image area of the film.

- **DIGITAL READERS** There are three types of digital readers: DTS, SRD, and SDDS. All of these digital systems can be adapted to existing projection systems. SRD and SDDS are positioned above the projector in a penthouse. They read the sound immediately prior to the film entering the projector, so the soundtrack is applicated well ahead of the compatible image on the film. DTS is read from a separate disk that is

synchronized to the appropriate film frame. All three systems have an optical track encoded onto the film as a backup. Each system is designed to automatically fall back to optical sound, if only for a fraction of a second, if the digital information is unable to be decoded.

CLEANING THE PROJECTOR

Cleanliness in all film-handling areas cannot be over-emphasized. The goal is to maintain a nearly "clean room" (close to pristine, one step removed from sterile) environment in the projection booth. Since the projector is the piece of equipment with which the film comes into regular contact, it should be kept completely free of dirt, dust, oil, and any other type of debris.

CAUTION! CLEAN PROJECTOR ONLY WHEN NO COMPONENTS ARE MOVING.

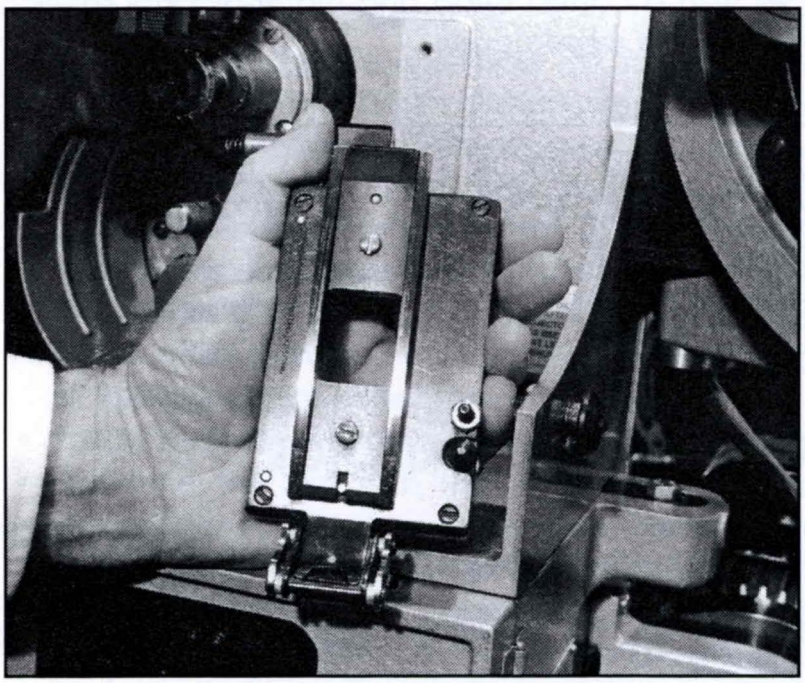
The projector should be cleaned after each movie performance using the following steps:

- Visually inspect the projector for signs of excessive dust and dirt, physical damage, frayed or damaged cables, and loose hardware.
- Look closely for emulsion shedding from the print itself.
- Remove all foreign matter from the pad roller arms, intermittent pressure pad, sound idler rollers, and runners in the trap and gate assembly. Use a soft, non-shedding cloth or camel hair brush. Canned air may be used for hard-to-reach spots, but make certain you are not stirring up more debris if you use it.
- Check to make sure that the entire film path and surrounding areas inside the projector housing are pristine with absolutely no loose particles adhering to surfaces.

A thorough cleaning should be completed at the end of the last performance of the day. This should be done every day without fail.

- Make sure that all cleaning tools are kept clean and in good condition so as not to further contaminate the projector as you clean. Projector cleaning tools should be used only for that purpose, not serving double duty on the popcorn popper!
- Open all projector components including lens turret and pad rollers.
- Remove film gate and trap assembly.

- Remove dust and foreign matter from projector using a soft lint-free cloth and compressed air (not more than 20 psi).
- Remove all dust and debris from pad roller arms, intermittent pressure pad, sound idler rollers, and in the trap and gate assembly using a toothbrush or camel hair brush.



Remove gate and trap to clean.

•Clean the rollers with cotton swabs and a 50-50 mix of water and denatured alcohol. Check the pad rollers for flat spots and free rotation. If any roller freezes, it may become worn enough so that the image area of the film will come into contact with it and cause severe abrasion on the film. As you clean, make sure that you do not splash cleaning solutions onto the lens surfaces.

- The bands of the film trap should be kept clean and free of emulsion deposits. After several feet of film have been projected, the trap bands may become hot enough to soften the film emulsion, destroying its capacity to be focused and making it tacky to the touch. If excess emulsion collect on the trap bands and dries rapidly, it hardens, causing noisy sprockets, picture unsteadiness, and perforation damage to the film. Clean film trap bands with a cotton swab that is well saturated with the water-alcohol solution. Occasionally, deposits may be seen on the gate pressure pads that contact the film base. The deposits can be removed with a lint-free cloth.
- The aperture plate may become a repository for dirt, dust, and emulsion build up because of its position in the gate. It should be cleaned with a Q-tip that is saturated with water-alcohol mixture. NEVER USE ANY OIL-BASED CLEANERS! (NOTE: While cleaning the aperture plate, check for burred edges that could collect hair or fibers.)
- Clean lenses and sound optics with a soft, oil-free camel hair brush. DO NOT USE THE SAME BRUSH ON OPTICS THAT IS USED TO CLEAN PROJECTOR!

NOTE: If any lens surface appears brightly illuminated, there are probably deposits on it. The lenses should be thoroughly cleaned weekly–or more frequently, as needed–with lens tissue that is well saturated with lens cleaner. NEVER USE ANY TISSUE OR CLEANER THAT IS NOT SPECIFICALLY FORMULATED TO BE USED ON THEATRE PROJECTION LENSES.

- Clean sensing devices with a cotton swab and water-alcohol solution. This will help prevent false and missed cues.

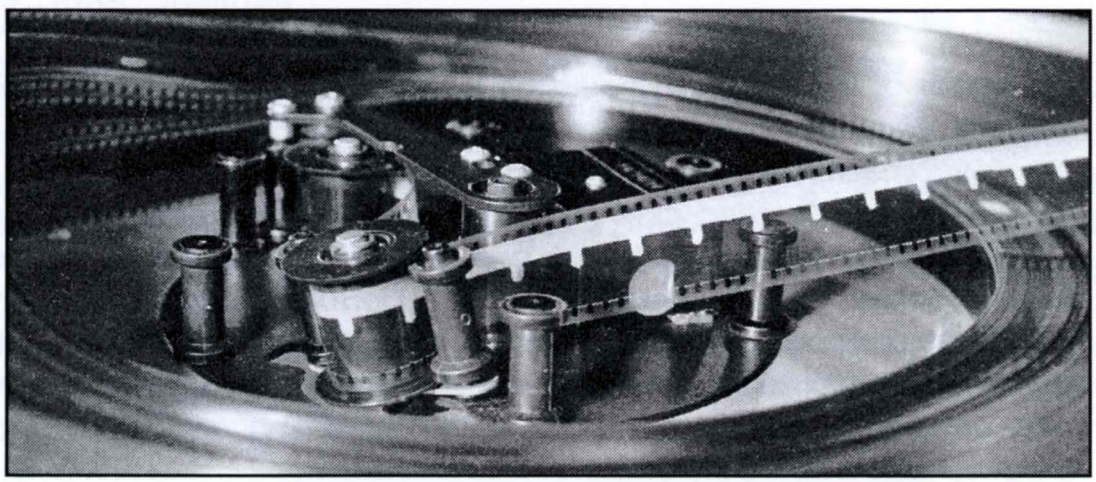
WARNING! NEVER LOOK DIRECTLY INTO THE LENS DURING PROJECTION. SEVERE EYE DAMAGE COULD RESULT.

THREADING THE PROJECTOR

With the exception of the optical sound drum for 35mm film, the image should not come into contact with any projector components.

When using platter transport, the following steps should be taken to thread the projector:

- Select which platter will take up the film.



Film is threaded through platter brain on the way to the projector.

- Remove the take-up ring from the movie to be shown and position it on the take-up platter.
- Thread the film from the center of the platter through the control centerpiece ("brain") and then to the feed roller on the platter column.
- Pull enough film to thread the projector, the platter system, and return to take-up ring.

- Fasten the film to the take-up ring so that the soundtrack is UP and film is winding in a COUNTERCLOCKWISE direction.
- Film loop size is CRITICAL. A 2-3 frame loop should be maintained between the gate and the intermittent as well as between the upper feed sprocket and the film gate.
- The optical sound head is designed to scan only the small area of the film containing the soundtrack. This soundtrack area can be identified as two transparent lines in a black area that runs the entire length of one side of the film between the edge of the picture and the perforations.
- NEVER LET FILM OR LEADER FALL ONTO THE FLOOR!
- Thread film through projector with soundtrack edge facing the operator. If this is not done, the exciter bulb will shine on the wrong edge of the film, resulting in absence of sound. For your information, there is a 21-frame offset between the picture frame being projected and location of the sound that corresponds with that frame.
- Follow projection film path diagram shown on the next page.
- Advance the film with the framing knobby hand to check proper threading.
- Check all rollers and sprockets to make sure the film is positively seated between roller flanges and secured over the sprocket teeth. Film sliding up and traveling over a roller edge is a common form or film scratching and one that is easily avoided if discovered at this stage.
- Check framing in the gate. Adjust as necessary prior to show start.
- Check to be sure the leader has been run down sufficiently so that a "countdown" is not the first image to flash onto the screen prior to the film.
- Run down the film to obtain adequate tension between the platter and projector so that no slack exists.

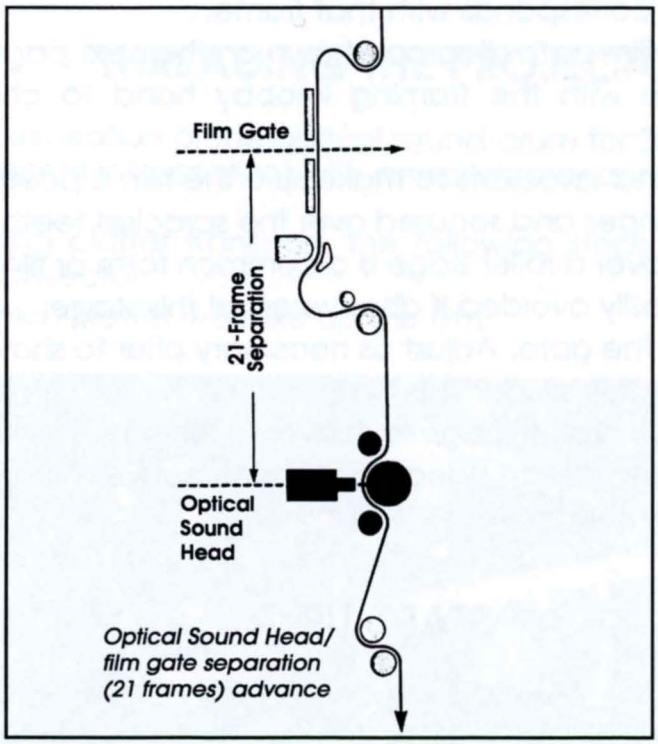
START-UP

When you push the appropriate button on the automation system, the movie should begin without problems. Here are the areas you should quickly check:

- **IMAGE SHARPNESS** Focus is easily adjusted while the film is running using the focus knob in the front of the projector near the lens mount. If film is difficult or impossible to focus, you cannot make further corrections while the film is running. However, here are some areas to check in your projection system during maintenance and repair time when the theatre is not open for business:
  1. Focus problems may arise when the heat from the lamp becomes excessive. The reflector should be aligned to provide sufficient screen luminance without creating a "hotspot." Extreme heat will permanently blister and damage film, making it separate and unable to be focused.

2. Film wound emulsion-out has built-in strains that decrease as the diameter of the reel increases. The strains can cause focus drift, an image which begins in focus, but gradually deteriorates and becomes "soft."
3. Dirty and clouded lenses create fuzzy images. Careful cleaning with lens tissue that has been saturated with lens cleaner will eliminate the problem.

- **FRAMING** The framing knob is used to adjust the image within the gate. The reason for the film loop at this point is so the framing may be adjusted slightly while the presentation is running. Problems here can be avoided by making sure that a full image appears in the gate prior to start-up and performing thorough checks during print build-up to ensure that all splices are in frame and made properly.

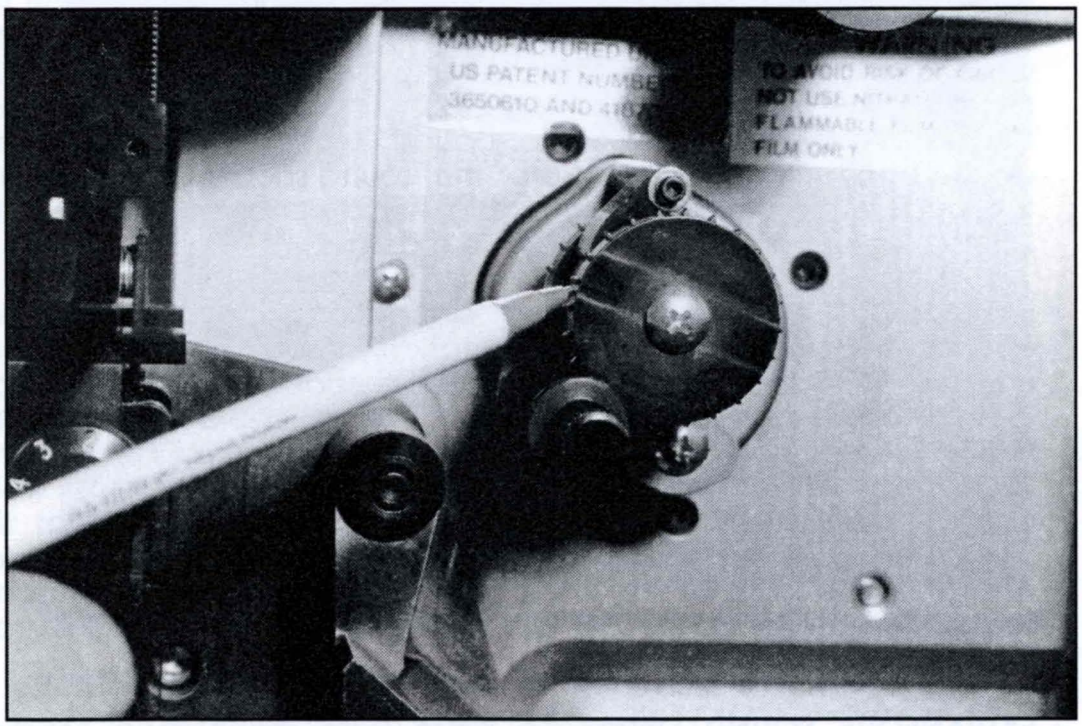


Projection film path threading diagram.

QUICK FIX A poorly-made splice must be fixed so it doesn't create a mis-frame each time the film runs. To remake a splice on a platter without dismantling the entire print, the mis-frame must be isolated. Keep a few small trailer cores that are clean and smooth nearby. As the mis-frame is taken up on the platter, place four cores, evenly spaced, between the wound portion and the section containing the bad splice. As the platter rotates, insert the cores and place them next to the section containing the splice. The take-up platter will proceed normally. At the conclusion of the presentation, carefully lift out the section of film between the two sets of cores, make the repair, slip the section back onto the platter. The entire operation should take only about five minutes.

- **IMAGE STEADINESS** Image steadiness can be either vertical (jump) or horizontal (weave), These conditions are very distracting to the audience. If the image is unsteady, examine the print for perforation damage. If none is found, check:
  1. **TENSION** Look for deposits on the trap bands as well as the fate tension. Adjust tension enough to steady the image without producing "clatter" at the intermittent sprocket.
  2. **FILM LUBRICATION** The first means of detection is to vary gate tension over the entire range. If no setting helps, inadequate film lubrication should be suspected. In an emergency, put a SMALL amount of Johnson's Paste Wax on your thumb and forefinger. Apply to alternating film edges VERY LIGHTLY just before the film enters the gate.

  3. **SPROCKETS** Check all sprocket teeth for hooks, burrs, or other signs of wear. If any of the teeth are damaged, replace the sprocket wheel.



Carefully check sprocket teeth for wear, hooks, and burrs.

4. **INTERMITTENT** Check the intermittent mechanism if no perforation damage is found, the gate is clean, film lubricated, and tension adjustment do not alleviate the problem. The first indication of tooth wear is a "ticking" sound as the film leaves the intermittent sprocket. The ticking is most noticeable when advancing the film by hand. Unsteadiness will result if a sprocket groove is allowed to become too deep. A new sprocket must be installed. The intermittent movement should be removed and replaced if the intermittent sprocket is found to be free of wear. Unsteadiness may occur as a result of wear on the cam (star wheel). However, this cannot be determined at the theatre. It must be evaluated at the factory. The shutter is re-timed after an intermittent is replaced.

- **SOUND SYSTEM CHECK** Theatre sound substantially enhances the audience experience. It has become nearly as important as the image in the minds of an increasingly-sophisticated audience. All sound processing equipment and amplifiers in the sound rack should be turned on. The sound system electronics are like a pipeline. If one switch along the line is not on (or set properly) the signal will not flow, just like a closed valve in a pipeline. Ninety-nine percent of all problems are solved by considering the signal flow path. All of the equipment along the line should be turned on and set to allow the signal to flow through to the speakers. The booth monitor indicates what the signal sound like when leaving the amp on its way to the speakers. The operator should listen to the monitor regularly to check the sound quality. If speaker output quality is poor, it will not be heard on the booth monitor. Because of this, sound should be checked in the auditoriums several times during each performance. (See the SOUND section of this manual for more details)

- **EXTRANEOUS LIGHT** Unwanted distractions may occur in an auditorium to disrupt the presentation. Visual distractions may originate within the auditorium itself, the outdoors, or from the lobby. To evaluate extraneous light on your screen, stand at the screen facing the rear wall. The houselights should be dimmed to their normal level, the projector should not be running. If you can read the white pages of a standard telephone directory while standing at the screen, the level of stray light is much too high. Check for unshielded exit lights, the level of the running lights, aisle lighting, lobby lights, sunlight for exterior doors, and light shining through the port glass from the booth.

- **EXTRANEOUS SOUND** Distracting noise from mechanical sources, employees, or customers can also effect the entertainment experience. Sit inside the auditorium. Listen for noise generated by the heating, ventilating, and air conditioning system (HVAC), start-up noise, poorly timed fans, and system vibrations. Periodically check all of the auditorium seats for squeaks. They have moving parts and will require regular maintenance and lubrication to function properly and silently. While watching the film, listen to the noise generated from the booth such as the projector or people talking. If either can be heard, check for leaks around the port glass and seal as necessary.

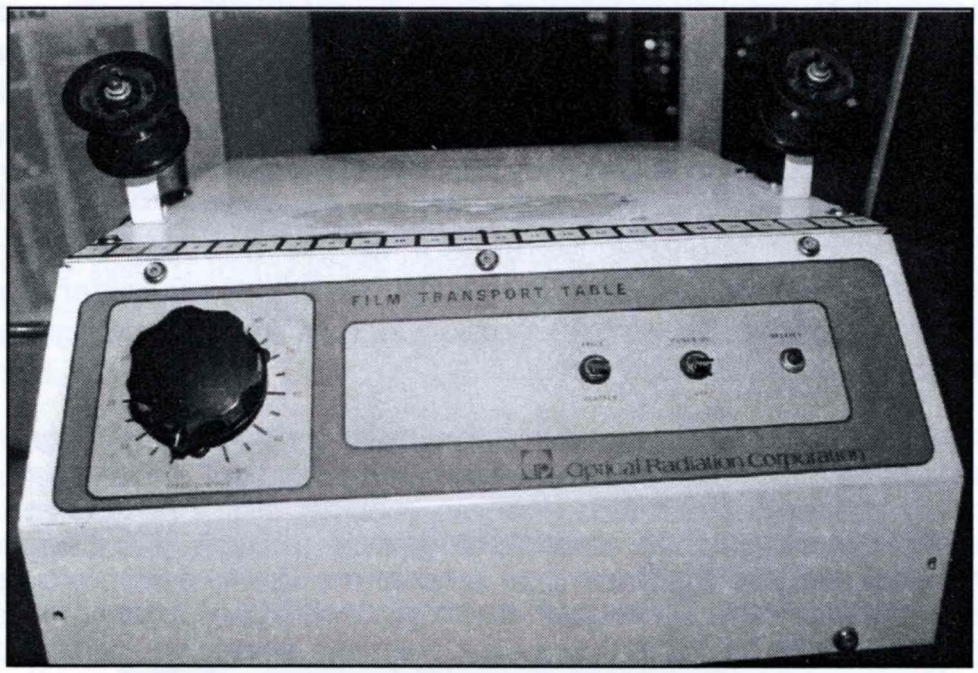
PRINT TEAR DOWN

As with the build-up process, lint-free gloves should be worn during tear-down to preserve image quality and minimize oil and dirt.Be considerate of those receiving the print next. Remove all sensing tape and properly mark all reels.

When rewinding, start at the lowest speed possible to prevent film breakage or binding. The tension at the hub of the shipping reel on the make-up table is extremely high at the beginning of the rewind process, so this is an important practice.

It is equally important to maintain a constant speed. If speed fluctuates, loose laps of film may be produced, leaving cinch marks on the image. When rewinding at high speeds under low humidity conditions, static electric charges may be generated that will draw dirt and foreign substances to the film surface. To minimize this, rewind slowly and use humidity control or static dissipation devices.

ON THE MAKE-UP TABLE



Regulate the speed control to avoid damaging the film with excessive speed.

- Set the speed control on the make-up table at minimum.
- Place the power switch in the OFF position.
- Then plug the interconnecting cable on the make-up table into the socket at the base of the platter tower.
- Place the take-up reel on the side of the spindle on the make-up table.
- Adjust the rollers on the vertical pole of the make-up table for optimum alignment with the platter.
- Thread the film from the outside of the disk through the table rollers and onto the reel in a counterclockwise direction, soundtrack facing in.

- Place the power switch on the table in the ON position.
- Slowly increase the speed control dial until the desired speed is reached and transfer the film from platter to reel.
- Make all speed changes VERY SLOWLY. Remember that the film is pulling on a full platter (100-150 pounds). If sudden speed changes are made, the film will break and the platter will continue to rotate.

REPAIR AND REPLACEMENT

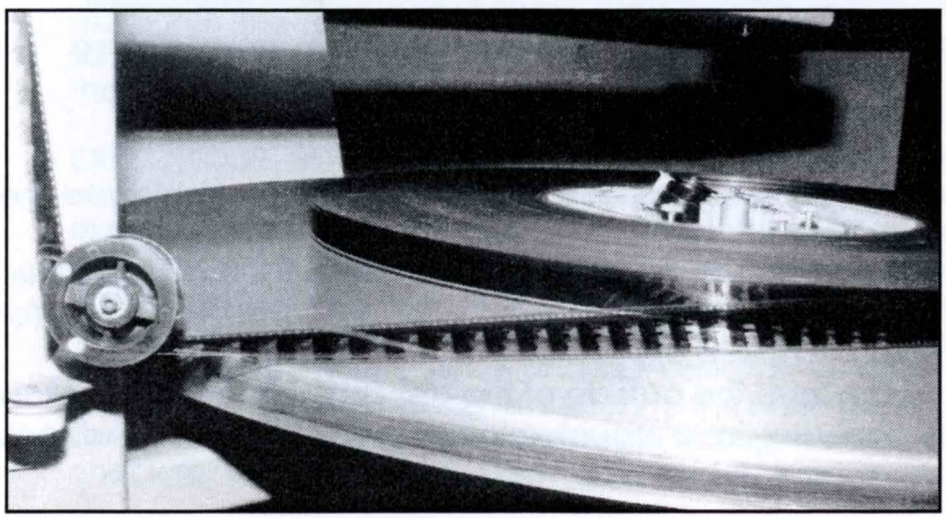
PROJECTOR

INTERMITTENT Look for the following symptoms that will alert you to potentially damaging intermittent movement and sprocket conditions *before* the damage becomes more serious:

- Image unsteadiness that cannot be attributed to perforation damage, deposits on trap rails, or improper gate tension;
- A ticking sound as the film leaves the sprocket. (This is easiest to hear when advancing the film by hand. Perforations are catching as the film leaves the sprocket. Installation of a new sprocket is recommended.)
- Improperly maintained oil levels in the intermittent reservoir will not provide adequate lubrication. Check for foaming of the projector oil as well. Oil that foams will not lubricate the system. It must be changed.
- A metallic scraping sound may indicate sprocket shoe misalignment or a damaged tooth rubbing against a component.
- Wear and/or improper adjustment of the cam/pin interface will manifest itself with a clicking sound just before the intermittent sprocket begins to move. Have a technician look at the intermittent sprocket before serious damage occurs.

SPROCKETS Occasionally check all sprockets for wear and undercutting. Reversal or replacement may be necessary.

ROLLERS Rollers should be monitored for easy rotation. If a roller freezes, wear will occur, allowing the image area of the film to come into contact with the roller surface. Rollers with bearings that do not rotate freely must



Make sure rollers always rotate freely.

be replaced; others may be disassembled and cleaned. Most rollers are easily removed to clean the inner shaft. Plastic rollers should be lubricated with graphite or silicone lubricant.

MOTOR BRUSHES Check motor brushes monthly. Disconnect all power before performing this work. If there is any noticeable wear, the brushes should be replaced. They are accessible through the retaining cap located in the upper quarter of the motor cylinder. Unscrew the retaining cap and withdraw the spring and brush. Replace as necessary. Check all platter motors as well as motors on the make-up table.

APERTURE PLATE Check for aperture shadows. If the aperture plates were properly cut when installed, check the following before refiling them:

1. Has the position of the projector changed slightly? Realign the projector and re-check the plates.
2. Does the theatre use mirrors as a means to get the picture from the projector to the screen? Has the position of one of mirrors changed due to cleaning, internal work on the lamphouse, etc.? Adjust the mirror to eliminate the shadow.
3. Does the aperture plate fit snugly in the gate or does it wobble? It should be a tight, secure fit.

BREAKERS If a breaker has tripped, reset the breaker. If a breaker trips again, check for a short in the system. Breakers trip as a means of shutting down the system to minimize internal damage. Call your technician to troubleshoot the system. If a short is not discovered, replace the fuse or breaker. Spare breakers and fuses for all your booth equipment should be on hand.

LUBRICATION The majority of theatrical release prints are no longer lubricated at the lab. Usually, this is not a problem. But, occasionally a print has not had time to cure properly and the surface at the edges becomes tacky due to friction and heat, allowing small deposits of emulsion to collect on the projector trap bands. These deposits increase the force necessary to move the film through the projector. This increased tension exerts excessive pressure causing the perforations to tear. Film lubrication at the theatre should be considered strictly an emergency matter and should not become an ongoing practice. Apply a SMALL amount of Johnson's Paste Wax to your thumb and forefinger and apply SPARINGLY to alternate edges of the film as it enters the gate.

WARNING! NEVER LET YOUR HAND COME INTO CONTACT WITH MOVING PROJECTOR PARTS.

THE LAMPHOUSE

XENON BULB The xenon bulb is used for motion picture projection for several reasons: economy, stability, and providing a continuous light source. A bulb typically consists of two parallel tungsten electrodes enclosed in a quartz bulb that is filled with pressurized xenon gas.

CAUTION! THE XENON BULB CAN BE EXPLOSIVE. BEFORE OPENING THE LAMPHOUSE DOOR–EVEN WHEN POWER IS OFF–ALWAYS WEAR PERSONAL COVERINGS FOR YOUR OWN SAFETY. FAILURE TO DO SO MAY RESULT IN SEVERE INJURY.

The proper safety coverings are: a protective face shield extending below the neck area, a quilted ballistic nylon jacket covering the body from the neck to the mid-thigh–including arms to the wrist, and vinyl/coated gloves. These items are available through OSHA or your theatre supplier.

Before removing or installing a new xenon bulb, note the elapsed hours from your lamphouse meter on the warranty form packed with the bulb as well as on the card on the rear of the console panel. Then follow these installation procedures:

1. Unlock lamphouse access door. Remove screws on inner safety door, release the safety catch.
2. Turn off the power at the main line switch before removing the lamphouse cover. Open the door.
3. Take the bulb from the carton, LEAVING THE PROTECTIVE CASE ON. Check the bulb to ensure you have the proper wattage for your lamphouse.
4. Carefully feed the cathode (-) end of the lamp through the center of the reflector and into the focus mechanism.
5. Attach the anode (+) lead to the igniter circuit. Take care that the bulb is connected with the right polarity, the positive lead to the high voltage terminal, the negative lead to the rear terminal in the lamphouse. (OPERATING THE PROJECTOR WITH REVERSED POLARITY WILL RUIN THE BULB.)
6. Make sure the positive lead from the bulb to the igniter DOES NOT TOUCH or tun close to any metal parts, the reflector, or the cooling duct. High voltage arcing and shorting may occur and the bulb may not ignite.
7. Avoid touching the quartz of the bulb with bare hands. When the bulb becomes hot, the oils from hands are absorbed by the quartz causing the bulb to become weakened and increasing the potential for explosion. If accidental touching occurs, carefully wipe the bulb with a lint-free cloth moistened with denatured alcohol.

(CAUTION: ALCOHOL IS HIGHLY FLAMMABLE. MAKE SURE BULB IS COMPLETELY DRY LONG BEFORE YOU PLAN TO STRIKE IT.)

8. For optimum light output, check bulb alignment. Follow the lamphouse manufacturer's guidelines for alignment.
9. Close the safety door and secure with screws.
10. Close the lamp access door. The console will not operate unless the door is secure.

The life expectancy of the xenon bulb should meet or exceed the warranty period for the bulb. Check the lamphouse electrical connections on a monthly basis. The heating and cooling of the bulb can cause some bulb connections to loosen or build up a layer of oxidation. The resulting bad connection can cause the bulb base to overheat, often leading to premature bulb failure. The bulb would be lost as well as the connector. If the connector has been damaged and not replaced, it will cause bulb failure in the new bulb.

With age, the quartz enclosure darkens due to deposits of evaporated electrodes. This blackening reduces the onscreen light. In order to compensate for this light reduction, the operating current to the bulb can be increased, within a limited range.

ALWAYS wear protective clothing when handling a xenon bulb.

Upon installation, the bulb may be operated at 85% of its rated current. As the bulb ages and darkens, the current may be increased to achieve proper screen illumination (16 footlamberts, center screen with no more than 2 ftL falloff on the rest of the screen). Excessively high current will shorten bulb life, as will excessively low current. It is important to maintain the current within the optimal range.

BULB MAINTENANCE Dirt and dust accumulate on the xenon bulb, as with all projection components. Allowing the dust to build up not only reduces light output, but also increases the potential for bulb explosion. Most bulb contamination can be reduced by wiping the bulb with a lint-free cloth. Oil from fingers or the environment should be removed with denatured alcohol and a lint-free cloth on a monthly basis. Since excessive cleaning of optical components can be more harmful than helpful, the surface should be cleaned as described only when the surfaces are really dirty. To clean:

1. Remove the xenon lamp.
2. Brush all surfaces inside lamphouse with soft, camel hair brush.
3. Blow any remaining particles away with compressed air or an ear syringe.
4. For surfaces that are really dirty, moisten a pad of cotton with a mild detergent (do this ONLY if denatured alcohol does not remove the dirt), Gently swab the exposed lens or mirror surface, using a spiral motion and working from the center of the surface to the edge. Sponge up moisture with lens tissue. Never use the lens tissue for more than one sponging.
5. Repeat procedure #4 as required. When exposed lens or mirror surfaces are dry and clean, loosen any remaining lint with the brush and compressed air.
6. Replace and realign the xenon bulb.

A bulb being operated in the horizontal position should be rotated 180 degrees at half of the warranty life. More frequent rotation will be necessary if the projection angle is severe.

LAMPHOUSE VENTILATION The lamphouse must be vented to a minimum 8-inch diameter external exhaust duct. DO NOT connect the lamphouse stack into the air conditioning system which recirculates air elsewhere. On a monthly basis, remove the dust build-up from the air intake and outlet parts. Ensure that the exhaust is not clogged and the roof fans are operating. Proper ventilation is essential for prolonging bulb life.

BULB STORAGE The xenon bulb should be stored in the protective casing and box in which it was shipped. New bulbs or spare bulbs should be stored vertically. Be sure that bulbs are stored in the coolest spot in the booth and never subjected to heat from any equipment that may be in the proximity.

HOTSPOTS AND FILM DAMAGE Damage to the film through the lamphouse may be caused by a variety of reasons including improper lamp-to-mirror distance and incorrect distance between lamphouse and projector. Embossing or blistering of film occurs when the heat becomes excessive on the film surface. The metallic silver grains in the emulsion layer absorb substantial amounts of energy (particularly in black and white film). If the lamphouse is poorly adjusted–resulting in maximal center-screen illumination (hotspot)–separation between the emulsion and base of the film may happen. The emulsion surface will become hard and crusty; the base will be brittle and distorted. The film will be ruined and unable to be projected.

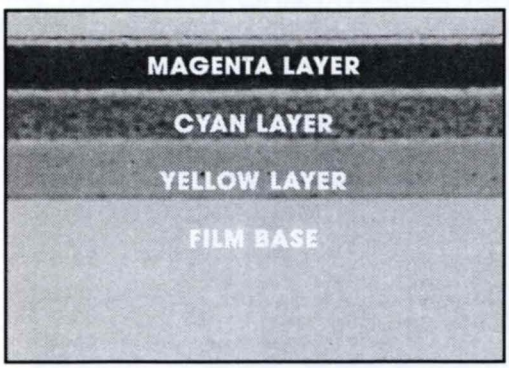
Film

FILM MANUFACTURING & COMPOSITION

What is motion picture film? The American National Standards Institute (ANSI) defines it as "a thin, flexible strip of plastic, complying with a dimensional standard as defined herein, whose use is specific to the process of manufacturing a motion picture."

The characteristics built into motion-picture film become very important in exposing, transporting, storing, handling, preserving, and repairing film, and in the necessities for extended life storage.

Motion picture film is made up of layers, and it's the combination of these layers that gives the film its character. It has a supporting layer called the *base*. This base must be transparent, free from imperfections, chemically stable, insensitive photographically, and resistant to moisture and processing chemicals, while remaining mechanically strong, resistant to tearing, flexible, dimensionally stable and free from physical distortions.



The dye layers on Eastman Color Print film register various parts of the film's color. Together, they make up the film emulsion layer.

Fundamentally, film has two main parts: the base and the *emulsion layers*. Emulsion adheres to the base by means of a binder. To manufacture acetate-based film, cotton-lint fibers or wood pulp are purified, treated with chemicals and solvents, and mixed and stirred to make a thick liquid from their cellulose–one of nature's building blacks related to sugars and starches. This liquid-cellulose triacetate is cooked, dried into pellets, and put through more chemical and mechanical paces. It is filtered and placed in a partial vacuum to remove trapped air that might cause bubbles.

This clear liquid plastic, *dope*. Is squeezed through a very narrow slit onto huge, highly polished wheels where it dries into a thin, uniform layer as the wheel turns. When the solvents in the dope evaporate, a tough, clear, remarkably uniform layer is created. All this is done in extremely clean *white rooms* (also known as *clean rooms*). The manufacture of polyester base essentially follows that of acetate-base film. However, polyester is chemically constituted in a somewhat different way–principally different is the absence of solvents and the method by which it is formed into a transparent web.

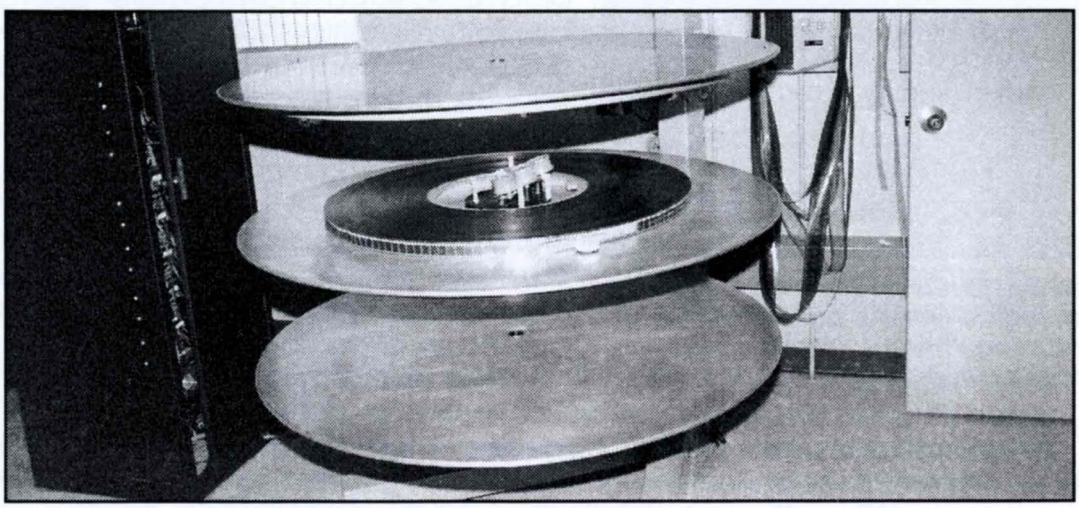
The photographic part of motion-picture film is the emulsion. After the medium–usually gelatin–is made, it is mixed with the light-sensitive silver salts, and then spread uniformly onto the film base, dried, and cut into the desired width.

Color print film contains three dye layers that register various parts of the color, one on top of the other, for the full-color effect. The top layer is clear gelatin, followed by a cyan dye layer, a magenta one, and a yellow one. These comprise the emulsion, which adheres to the base by means of a binder.

Although the gelatin layer is hardly indestructible, it is made to withstand various some processes necessary to projection. Moderate heat would be one of these processes. But heat coupled with high relative humidity can degrade film into a sticky mess.

The finished film goes into cameras to capture the magic of the movie-making production. When seen by the motion-picture camera, usually at the rate of 24-frames-per-second, the silver salts undergo an invisible change that stores a *latent image*, where light falls upon it, until the film is developed.

It is impressive to note that raw film stock is manufactured in the dark to extremely precise tolerances. The sanitary conditions are pristine. No airborne impurities, light, or any other radiant energy must disturb the high sensitivity of raw film. The air in these manufacturing rooms is filtered and changed many times an hour. Specially laundered lint-free white uniforms are worn. Certain cosmetics and medications that might interact chemically with the film are forbidden. Everything is vacuumed and scrubbed at regular intervals. Daily samples of raw materials and film are tested against carefully determined standards, including extremes of heat and relative humidity.



Keep film-handling areas as perfectly clean as possible.

Although it is unlikely that any projection booth could ever simulate this flawless environment, the closer a booth comes to maintaining very high standards, the less likely that projection problems will occur with the film.

MAKING MOVIES

Detailing the creative process is best left to those who actively participate in it. For the purposes of understanding film as the medium used to tell stories in a theatrical projection format, however, several facts should be mentioned:

1. 35mm film travels at 24 frames-per-second through a standard theatre projector. This translates to 90 feet-per-minute.
2. A typical theatrical release that is two hours long uses approximately 10,800 feet of film. This does not include any trailers that may be attached to the head that promote upcoming feature films.
3. When a feature film is produced, shooting ratios are figured at a minimum amount of at least 20:1, meaning that 20 feet of film are shot for every usable foot of film that makes it to the theatrical release print.
4. The film used to capture moving images on a production set is different from that used in release prints. It is known as *camera negative*. At a 20:1 shooting ratio, more than 200,000 feet of camera negative is used for a movie running just under two hours.
5. If more than one camera is used, the amount mentioned above can double or triple, depending upon the number of cameras used.
6. The amount of camera negative can also dramatically increase when used by a painstaking director who captures many "takes" of given scenes.
7. There is an intermediate type of film used between the camera negative and the release print stock so as to preserve the original negative when making thousands of release prints. This type of film, appropriately, is known as *intermediate stock*.
8. The film duplication process goes from negative to positive at each of the three stages, each using a film stock designed for that specific phase. The theatrical release print, then, has gone from the original camera negative/positive to the intermediate negative/positive to the print stock negative/positive.

THE LABORATORY

Labs offer a variety of services to production and distribution. Although not all services are offered by every lab, some of the principal lab functions include:

1. Furnishing advice to assist with technical or even aesthetic production difficulties.
2. Developing and processing camera film. Processing typically involves moving the film through an appropriate sequence of developers, fixers, baths, washes, and drying at carefully-controlled speed and temperature.
3. Printing and duplication from camera film for workprint or release prints. Most labs will print or duplicate the film after it has been processed. They may also hold the original negative in their vault and forward the original print for use as a workprint. Thus, the original negative is protected until needed for final conforming.

4. Edge numbering of the originals and workprint facilitates editing.
5. Editing, cutting, splicing, and assembling the print may be done at the lab if the producer requests it.
6. Conforming matches the original camera film to the workprint after editing is completed.
7. Labs can also provide post-production services such as optical effects, dissolves, wipes, fades, freeze-frames, etc.
8. Film cleaning utilizing ultrasonic cleaners may be a lab function. Using sound waves, this type of cleaner will remove dirt and dust particles from the film, even very deeply embedded dirt.

PRODUCTION SERVICES Many labs provide daily services for each day's "dailies"or "rushes" so that the Director of Photography and the movie's Director can see the results of their day's work no later than the day following. Having a lab provide this crucial and cost-effective service during the actual production of a movie can save a great deal of time and money by allowing the creative people to see the results of their efforts immediately so that costly re-shoots can be avoided much later in the process.

The work on "dailies" usually proceeds thusly: After receiving the film from the production company, the lab rewinds each roll in total darkness. This is done to check the edges of the film for breaks or damage to ensure film break do not occur during processing. Following this the film is processed.

The film rolls are then visually checked for the scene and take number on the clapstick. Using logs provided by the production company, the acceptable takes are spliced together in 1,000-foot rolls and referred to as the "A" negative. The other takes are spliced together and referred to as the "B" negative. The "B" negative is put into the film vault to provide "insurance" takes, if needed.

The "A" negative rolls are sent to timing where they are viewed on a Hazeltine color analyzer. This converts the negative film image into a positive image on a color TV tube and indicates the printer exposure that will provide a properly-colored print from the negative. Within several hours, the printed film is moved to a review room where it is projected for inspection.

The lab representative viewing the film does not make creative decisions, but checks for focus problems, unacceptable exposures, scratches, microphones showing in the scene, and so forth. This representative reports to the Director of Photography and the Director the next morning so that any necessary re-shooting can take place.

The rush prints are sent from the lab to the post-production offices. During the night, the sound department will have the recorded dialogue organized so the creative people are able to hear as well as view the prior day's work. This scenario is repeated each day the movie is in production.

During the post production period, the editing, sound work, and visual effects work is completed. Depending upon the amount of special effects to be incorporated (REMEMBER: A "special effect" is anything that is not live-action photography, including dissolves, wipes, fades, titles, etc.), the post-production process takes several months, at a minimum.

DISTRIBUTION SERVICES The "answer print" is the finished product. When this is turned over to the distributor, the production company's functions are usually considered completed.

The distributor places the print order with the lab and the lab begins by making positive copies of the 1,000-foot rolls of conformed negative, using the intermediate stock. These rolls are spliced together and made into several full-length duplicate negatives. Theatrical release prints are made from these "inter-negatives."

Release prints configurations include the traditional 2,000-foot shipping reels and the newer ELR's (extended-length reels) that hold 6,000 to 7,500 feet of film. Each 2,000-foot reel holds about twenty minutes of film, each ELR holds an hour or a bit more, depending upon reel capacity.

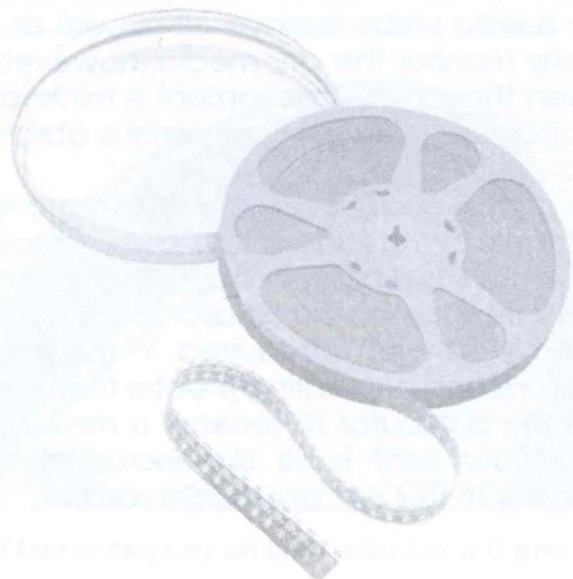
The lab usually runs all the reels of a specific reel-number together (i.e., all the Reel #1's, then all the #2's, and so on). In cases where the head-credits and end-credits of a feature film are still being "negotiated" by producer or distributor, the first and last reels are sometimes run at the last possible moment.

THE FILM EXCHANGE

Following the completion of printing at the lab, the film reels are sent to a *film exchange,* normally wrapped in plastic and placed in boxes. Although the lab will mount the film on shipping reels, if specifically commissioned and paid to do so by the distributor, it is usually the exchange that fills this important role.

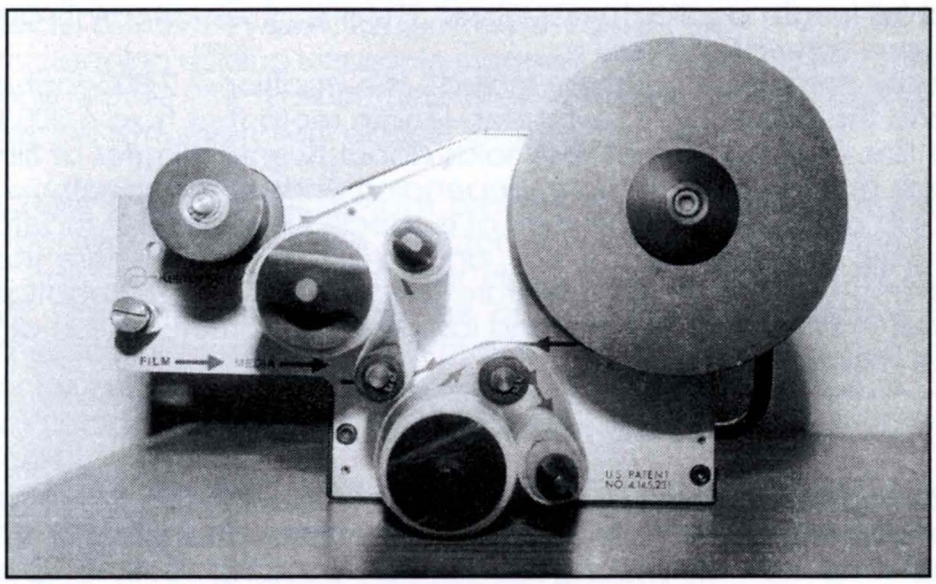
The film exchange serves as a depository and inspection/distribution center for theatrical release prints. The degree of inspection at the exchange is determined by contractual agreement between the film producers and distributors and the exchange itself.

At the time of this printing, three separate film exchange companies mount, inspect, ship, and store film. Each operates through agreements with distributors. It is the distributor who determines the reel configuration, degree of inspection during mounting, when the film will be shipped, picked up at the theatre, and how it will be inspected and/or stored upon its return to the exchange.



FILM HANDLING & CARE AT THE THEATRE

When the print arrives, make sure it is the correct title. Proceed to inspect the film carefully, as outlined in the opening section of this projection manual.

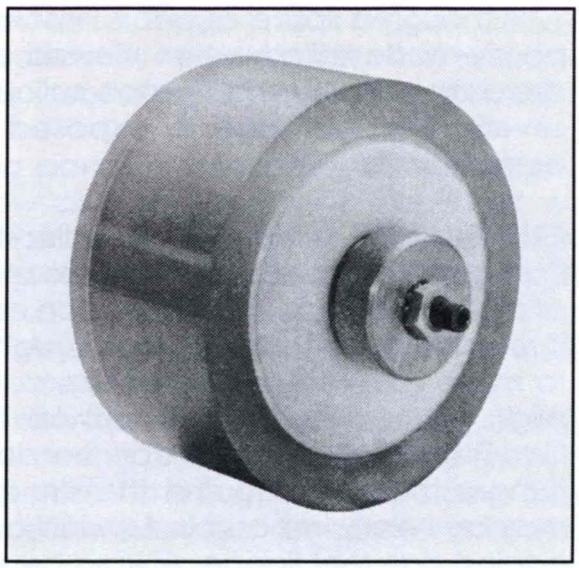


A dry media web-type film cleaner.

FILM CLEANING The only methods of film cleaning recommended to be undertaken in a projection booth are the use of continuous film-cleaning systems. FPC's *particle transfer rollers* (PTR's) are made of a slightly tacky, inert polyurethane. These are available directly from FPC as individual rollers or from several manufacturers that have positioned the rollers in clusters on various types of mounts. The *dry media web* cleaners are continuous-clean platter tower attachments that are effective as well. PTR's should be wiped clean with a damp cloth between shows. They are effective in removing particles as small as 10 micrometers. Dust, dirt, and random particles are removed as the film passes over the PTR's during projection. The dry media webs remove oil as well as dirt and dust. It is important to carefully monitor the dry media, however, to make sure it is always rotating, even though the movement is minimal. If the dry media ceases to move, it can potentially cause serious abrasion to the film it is supposed to clean.

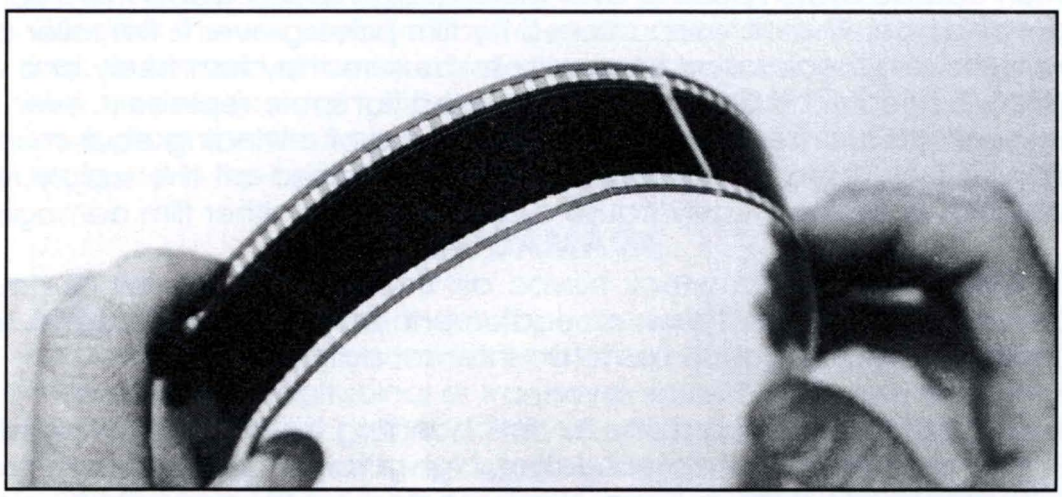
Heavy amounts of dirt and debris may be removed from film most effectively with ultrasonic film cleaners, available at most labs that process motion picture film. While small bottles of commercial film solvent might be available at your theatre supplier, the ultrasonic method is really superior to solvents when a heavy-duty job is required. In the interest of facilitating top-notch presentations and preventing theatre from being "dark" (no film to run), contacting the distributor to receive a new print is probably the optimum solution if your print is so dirt-encrusted that it cannot be continuously cleaned with PTR's or dry media webs.

FILM SPLICING There are two types of splices: cement (also known as "lab splices" or "hot splices") and tape. Tape splices are the preferred method for splicing film in projection booths. Tape splicing is the ONLY method that works for polyester film. Tape splices can be made easily and disassembled just as easily when tearing down the print for shipping. To make quality tap splices:



Close-up of particle transfer roller (PTR).

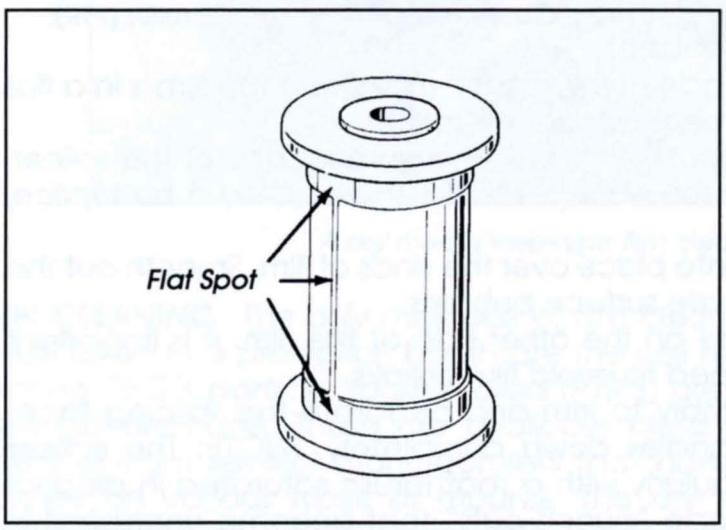
- Make sure the work area is as clean as possible.
- Wear lint-free film-handling gloves.
- Make precise cuts along the frame lines of the two ends of film using the cutting blade of the splicer; make sure the film is in a flat position over the alignment pins on the splicer.
- Place the two ends of cut film over the alignment pins of the splicer. Do not overlap. Match the ends perfectly. This is called a *butt splice*, not an *overlap*.
- Press the splicing tape into place over the ends of film. Smooth out the tape carefully to eliminate surface bubbles.
- Repeat tape procedure on the other side of the film. It is important that BOTH SIDES are taped to avoid film breaks.
- Lower the cutter assembly to trim and perforate the splicing tape, pressing the splicer handles down completely. (NOTE: The splicer should be cleaned regularly with a toothbrush saturated in alcohol to remove the sticky tape "punch-outs" that become encrusted in the splicer)
- Test the splice. A smooth curve should form over the splice when forming a loop between your hands.



Film spliced and taped properly on both sides forms a smooth, natural curve.

Although a splice appears onscreen for only a fraction of a second, a poorly-made splice, when viewed on a large screen, can be extremely distracting. Poorly-made tape splices can also increase the potential for severe film damage if exposed adhesive sticks to adjacent film convolutions.

FILM WINDING A skilled filmhandler strives for efficiency and effectiveness. During the manual rewinding process, don't change the winding speed, or allow loose laps of film that can easily produce distracting cinch marks. If rewinding manually, keep enough constant tension on the supply reel to make sure that individual film convolutions will not slip on each other. Align the rewind stands to provide a smooth wind on the edges of the film. Protruding film laps can be damaged in shipping cases or by reel flanges that push against the film roll. If the rewind spindles are bent, it may be nearly impossible to wind a smooth roll unless the film is handled against one reel flange. Always be sure the flanges are free from burrs or nicks that can damage the film edge.



If a roller develops a "flat spot, "be sure to replace it.

Motorized bench-top film-rewinding gear is fairly simple to operate. The film travels directly from the supply reel to the take-up reel. If you're inspecting during this operation, be sure your gloves are free from oil and grit. Change them frequently and hold the film in the recommended way to avoid film abrasion. For the console-type rewind, check the idler rollers to see that they rotate freely. Rollers can bind and the constant friction caused by film passing over them at high speed wears them flat all the way across. The abrasion caused by film passing over a flat roller can be extensive. Check rollers frequently to be sure they turn freely and are properly lubricated. If a roller has developed flat spots, replace it, even if it does seem to turn freely. No matter what type of rewinding equipment is used, be sure that continuous tension is maintained on the supply reel. Loose laps of film can easily cause cinch marks and other film damage.

FILM STATIC Static can wreck havoc on the film itself as well as cause brainwraps and other types of equipment damage. Here are a few preventative maintenance tips to counteract static problems:

- Optimum relative humidity for film handling is 50 to 60 percent RH. Very dry conditions (winter heating, high altitude, desert climate) tend to aggravate static buildup. Purchase and use an accurate humidity gauge. Some very good electronic units with digital readouts are

available for less than $30. (For instance, Radio Shack Model 63-855) the less expensive home devices often fail to hold calibration and are inaccurate. If possible, adjust the booth HVAC balance to maintain desired humidity.

- Add moisture to the air by using portable humidifiers in the booth. Evaporative humidifiers that blow air through a wet foam belt or cartridge are best. Do not use ultrasonic or "cold mist" vaporizers that actually spray water droplets into the air. Minerals in the water will accumulate as white powder and may cause problems with electronic equipment. Hot steam vaporizers are expensive to run and usually have insufficient capacity to humidify large rooms.
- Increase the moisture content of the film overnight by placing a wet sponge in a dish inside the film roll on the platter. Cover with a tent of clear polyethylene plastic (the type used in a painter's dropcloth). The film emulsion will pick up some moisture overnight. Be careful to avoid getting the film or platter wet.
- Platters with non-conductive (plastic, enamel, or anodized) surfaces tend to have more static problems than platters with metal surfaces. Check the surface conductivity with an ohmmeter. Non-conductive surfaces should be regularly treated with conductive anti-stats. Industrial anti-static sprays are available from suppliers of electronic or computer equipment for use on computer monitors and furnishings. Even laundry products intended to eliminate "static cling" will help. Treat the platter surface, rollers, guide-posts, and all other non-conductive materials that contact the film. Be careful that these anti-stats do not come into contact with the film.
- If PTR's (particle transfer rollers) are used to clean the print, use conductive PTR's to minimize static buildup.
- Always wind film emulsion side in (toward the platter center). This seems to minimize static problems as well as improve focus stability.
- Because brainwraps present a danger when static problems occur with polyester film, use a tension-sensing failsafe. This type of device automatically shuts off the equipment or cuts the film if the tension becomes excessive. These failsafes should be used in addition to film break detectors that simply sense when the film breaks.
- Consider the use of static control methods such as corona discharge ionizers (ionized air conducts electricity to help discharge static), anti-stat brushes (contain soft carbon or metal fibers to bleed charge away from the film), or metal garland. Suppliers and consultants can be found in the telephone book Yellow Pages under "Static Controls"

FILM DAMAGE

- **ABRASION** Any abnormal disturbance in the image area is known as "abrasion". This term commonly refers to fine scratches in the print. These may be longitudinal or transverse scratches or very small cinch-type marks caused by the action of embedded dirt rubbing against film convolutions during winding. Loose film convolutions can slip against each other to cause abrasions. Continuous scratches along the length of the film are generally caused by external means such as

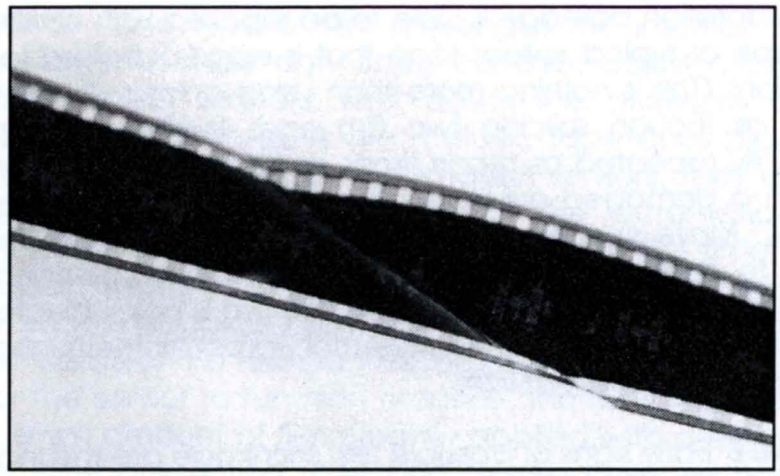
contact with equipment components, or with dirty and worn rollers in the film path. Emulsion abrasion on color film are less tolerable than base scratches. Emulsion scratching typically manifests itself in color, indicating the depth of the scratch into the dye layers. If the abrasion damage is white, this absence of color indicates that the scratch has gone all the way through to the film base since all of the emulsion has been removed. Base abrasion appears as black lines because light shining through the clear base layer is refracted by the uneven surface of the scratches. The presence of even minor abrasion should lead to a thorough investigation of all areas of film contact in the projection and transport systems: rollers, gates, flanges, aperture plates, lateral guides, platter edges, and so forth.

- **BLISTERING** Much like human skin, film burns start as swellings, grow into blisters, and regress to destruction. A burn spot on the film surface causes the emulsion to harden and become crusty. It may even separate from the base. The base may also become distorted and brittle. Extensive burn damage must be removed. Burns and blisters generally occur because the film has slowed or stopped during projection, causing the xenon bulb to seriously abrade the slow-(or non-) moving film. Equipment malfunction or slowdown due to a film break are probable causes of blistering.

- **BREAKS** Film separations can be caused by dry or shrunken film, poor splices, or mishandling of the film. When a break is repaired, make sure that the film ends are properly aligned and taped on both sides to avoid a recurrence.

- **BRITTLENESS** Although polyester film is more resistant to brittleness than that which is acetate-based, it may also fall victim to loss of moisture. Brittleness is recognized when it is no longer possible to bend the film over sharply on itself (emulsion out) without having the film snap or break. Since shrinkage often accompanies brittleness, the film perforations may fit more snugly over the pins of film splicer and other similar devices that may cause damage to the perforation edges. Edge brittleness is more common that film toward the center because the outside has been more fully exposed to atmospheric conditions. Unless damage is extreme, a print is generally able to be "re-moisturized" by placing a wet sponge next to the film as it rests on a platter. Cover the platter. The emulsion will regain some of its suppleness overnight.

- **COLOR SHIFT** Color shifts and variances are rare occurrences. Although they are not usually the result of mis-handling at the theatre, maintenance of proper temperature and relative humidity levels in the booth contribute to crisp, saturated color on the print. Also keep the projection area free from smoke, nicotine residue, and all oxidizing agents.



Creased film in a reel is just waiting to cause a problem. If the crease cannot be smoothed out, excise it.

- **CREASES** A crease is a sharp fold line or crack in the film. Creases should always be spliced out because they can lead to further damage and image deterioration. Creases and folds can occur in leaders and trailers, particularly when poor winding, untaped film ends, use of inadequate reels, or some other film-handling deficiency spills film onto the floor.

- **EDGE DAMAGE** A nick, crack, cut, or tear to the edge of a print greatly increases the film's chance of breaking. Film damage must not go unchecked. The leading causes of edge damage are damaged film reels, wobbles from bent spindles, and dry/brittle film.

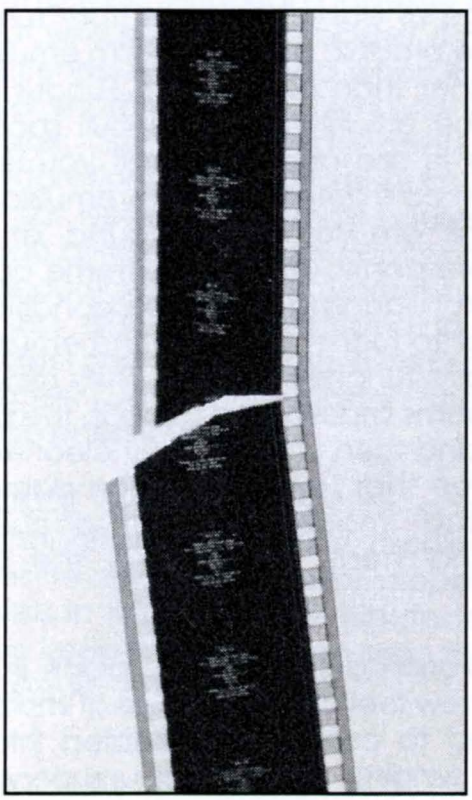
- **EMULSION DETERIORATION** This type of damage results from fungus, mold, and mildew. These attack the organic part of the film emulsion, especially at relative humidity higher than 60 percent. Fungus and mold are most often found on the emulsion side as dull spots or irregular areas. The spots increase in size and number if you leave them unattended. Eventually, they can deteriorate the emulsion to the point of uselessness. Growths are sometimes found at the beginning of film rolls between loose convolutions. In extreme cases, the emulsion can be soft and sticky. Handling film in this condition is critical and care must be taken not to further damage the emulsion. If only small sections of the print have fungus problems. They may be excised. However, if the problem seems widespread through the print, the film must be thoroughly dried and then ultrasonically cleaned at a lab. Even this does not guarantee that serious emulsion damage leading to mottled and distorted images has not occurred. Avoidance of high humidity and heat situations is the best preventative maintenance.

- **PERFORATION DAMAGE** Most perforation damage takes place in the booth. It is frequently found in the first few feet of film because of improper threading or the film being allowed to come into repeated intense contact with the rewind when the winding operation is unsupervised.

Some perforation damage is able to be repaired with either perforation repair tape or typical splicer tape that is edge-punched to match film perforations (This is nothing more than using a tape splicer in the usual manner as though splicing two film ends together except that it is sequentially repeated as many times as necessary to cover all the film frames in a damaged area). Avoidance of edge damage is the best "remedy." Make sure you have the proper loop size, that the film is not allowed to "bang" against the bench on an unattended motorized rewind, that the film is not brittle, that the film is not subjected to erratic pulling motions, and that the projector sprocket teeth and pull-down claws are not excessively worn.

- **SHRINKAGE** Early signs of possible film shrinkage are the inability of the film to fit precisely over the registration pins in the splicing block and the film resisting threading. Because of the exact placement of the perforations, any shrinkage that changes that spacing is a problem that is not easily remedied. The suggestions listed in the STATIC and BRITTLENESS portions of this manual on the previous pages regarding FILM DAMAGE can help put moisture back into a film. If the print has experienced more than 1 percent shrinkage and is unable to be rejuvenated with moisture, it will be unable to be projected and must be replaced.

- **SPROCKET MARKS** Sprocket marks that are visible onscreen can be at least as distracting as scratches. If sprocket override has occurred in either the image portion of the film or the soundtrack area as a result of a printing or alignment error prior to the film's appearance at the theatre, it should be replaced. However, sprocket marking on the film can also be caused during projection due to faulty threading, misaligned splices, or worn parts in the projection path.

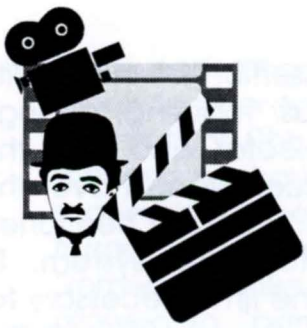


- **CONTAMINATION** Film sometimes becomes permanently damaged and contaminated by coming into contact with dirty work areas, soda, glue, coffee, cigarette ashes and nicotine, and even ungloved hands. Maintaining your projection booth and work area and ALWAYS wearing gloves when handling film are essential to minimizing film damage and maximizing customer enjoyment of the projected image.

If film becomes so brittle that it cracks or tears, splice out the damaged section.

FILM MARKING One type of film marking is the insertion of cues. With automation systems, cues can open curtains, adjust masking, change lenses, switch sound formats, shut down the projector and end the presentation. Automation cues are metallic tape cues placed over the film edge that are detected by automation sensors. They are positioned according to the sequencing length of the automation system. To calculate the correct cue tab placement, multiply the time necessary for the intermission sequence to be complete by 1.5. For example, if the intermission sequence takes 7 seconds, the tab should be placed 10.5 feet from the last frame of the feature. This method will work with all automation systems. For the sensor to function properly, the tabs must be free from oil and dirt. A small amount of film cleaner applied with a Q-tip will maintain cleanliness while preventing false and missed cues. All temporary cues that were placed on the film during its run should be removed before it leaves the theatre. A different type of cue is used in reel-to-reel systems, although reel-to-reel is rarely seen today. These systems require visual cues, which are small circles scratched into the film in the upper right corner. Although rarely used, they are still seen today on reel ends and are visible during screen presentation.

Another type of film marking is that which is done to enable easier film tear-down from the platter system at the conclusion of the film's run. This type of marking is done at the edges of the film so that the operator can quickly determine where the reel splices are located when pulling film from a platter onto the MUT (make-up table). Although the purpose of this type of edge marking is quick and easy identification of reel ends, it is at least equally important that the film not be damaged by the marking. Therefore, any substance of liquid that can dry onto the film and "flake" off must not be used. Flaking will result in dirt getting into the projector as the film runs through and becoming embedded in the image and soundtrack portions of the film itself. Shoe polish, "white-out," and nail polish MUST NOT BE USED on film under any circumstances. Acceptable methods for edge marking include placing the film on its edge and lightly running over the edge with a brightly-colored wax pencil or felt-tip pen. The preferred method of edge marking is the application of "Zebra tape." This is a hybrid of opaque and standard clear splicing tape in that the image portion of the tape is clear and only the edges are marked in bright yellow. The tape is placed over several frames of film at each reel end so that it can be seen easily as the film is traveling at high rates of speed while being pulled from a platter.



Screens

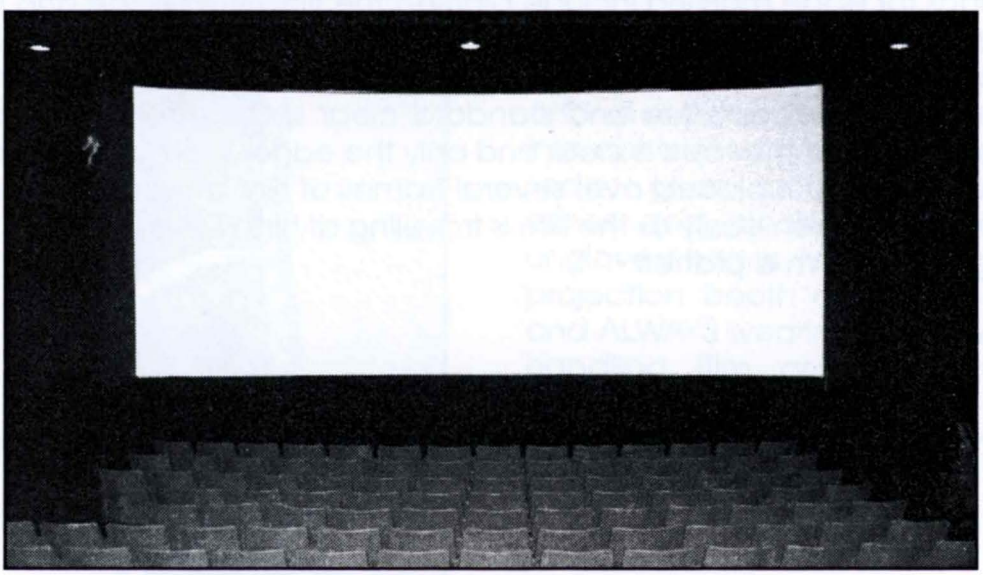
SCREEN SELECTION

Selecting a screen size and surface for a given auditorium involves a great deal more than simple aesthetics. Since the screen is the focal point of the theatre presentation for the audience, there are a number of considerations regarding screen size, type, and curvature.

Today's tendency toward installing larger screens and shorter projection distances requires lenses of shorter focal length. Inherent in this set-up are steep projection angles to the sides and corners of the screen. Unfortunately, it is all too common today to have good light in the center of the screen, but dramatic fall-off at the sides and corners, making for an overall dark and murky screen image.

Specification of screens, lenses, and the entire projection system should be laid out only by competent theatre architects and design engineers. Engaging the services of a traditional architectural firm that has little or no theatre auditorium design expertise is tantamount for asking for a substandard projected image.

Since most theatre managers and projection operators are not involved in the design stage of their respective theatres, a simple device can provide information necessary to determine the effectiveness of lens, screen, and light source working synergistically. For $10, you can purchase the Lens Selector and Picture Size Computer from Strong International. This slide-rule type aid was computed by cinema design expert Glenn Berggren for the specific purpose of correctly outfitting theatres with lenses, bulbs, screens, and seat configurations that work together to ensure a well-illuminated screen.



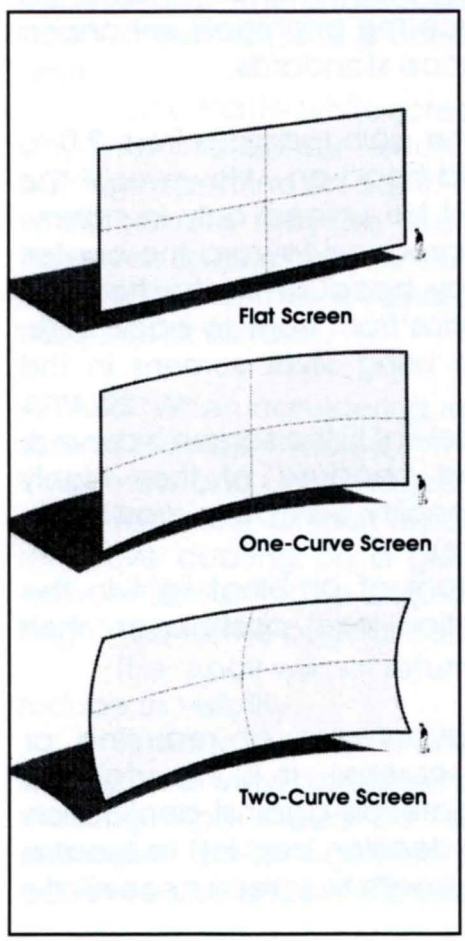
Projection "throw" from booth to screen is a critical consideration toward proper screen illumination.

Some of the factors to consider are:

- Size and shape of auditorium
- Seating configuration
- Screen height and width
- Screen surface material
- Screen curvature
- Aspect ratio
- Xenon bulb wattage
- Lens focal length
- Projection distance from booth to screen ("throw")
- First row distance to screen ("setback")
- Economic factors
- Use of curtains
- Amount of maintenance required to retain screen appearance and reflectivity

SCREEN TYPES Discussions of the reflective capability of screens often include the term "screen gain" It is defined as the level of reflectivity at a given angle of observation as compared with a universally accepted standard. The current standards is the amount of light reflected by the magnesium carbonated surface of a matte white screen as it is viewed head-on, at a 90-degree perpendicular angle.

No screen generates light and, therefore, no screen reflects more light than is projected onto it. But some screens project available light more efficiently than others–at least, they *seem* to do so, giving the illusion of increasing light. The three most common types of screen surfaces are matte white, pearlescent, and silver.



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- Matte white screens are difficult to illuminate without curvature because the non-reflective surface disperses light in all horizontal and vertical directions. But they are desirable in some installations for several reasons:
    1. They may be viewed from wider angles because the light is reflected to all areas;
    2. They offer uniform image and color resolution;
    3. They are the least expensive to purchase;
    4. They are the easiest screen surface to maintain.

    CAUTION: Since a matte screen has no brightness enhancers, it is of particular importance to limit all ambient light.

- Pearlescent screens have coated surfaces similar to mother-of-pearl and a center gain reading of approximately 2.0, although pearlescent screens are available with other gain levels as well. Brightness is enhanced by pearlescence, making the screen even more susceptible to "hot spots" and uneven light distribution, unless it is curved to contain ambient light. Advantages are:
    1. Brightness and measurable footlambert readings are substantially greater than on a matte screen;
    2. Pearlescent screens allow viewing angles approaching 60 degree of center with only slight fall-off at the sides;
    3. This type of gain screen is usually the one of choice for "bigscreens" (wider than 40 feet) since the brightness enhancers are necessary to meet SMPTE luminance standards.

- Silver screens are very high-gain, with center gain readings from 2.0 to 2.8. The image is very bright when viewed head on. However, if the screen is not curved, silver screens should be utilized only in narrow auditoriums where the audience may be grouped toward the center. Silver screens are not in wide usage today because of the trend to construct wider auditoriums with shorter ratios from front to back walls. However, there are some advantages to using silver screens in the proper installation:
    1. Brightness and illumination level is excellent IF the screen is curved;
    2. Silver screens are easily illuminated because of their highly directional ray reflection (this directionality can be a drawback, however, without significant curvature);
    3. Silver screens are slightly more tolerant of ambient light in the auditorium because of the illumination level possible on their surfaces.

CURVATURE Curved screens offer the advantages of reducing or eliminating problems inherent in high-gain screens. It is important to balance the diffusion properties of screen materials against application requirements. Screen curvature and gain are decision best left to theatre design engineers. Today's shorter throws from booth to screen necessitate

more complex engineering specifications. However, a simplistic approach to screen curvature reveals several advantages:

1. Light disperses more evenly over curved screens, particularly those that are curved both horizontally and vertically;
2. Curvature significantly reduces light fall-off at sides and corners;
3. Curved screens minimize light that is radiated onto walls, thereby being rendered useless toward screen illumination;
4. Screen curvature directs available light toward the audience, providing more luminous images onscreen.

CLEANING Deficient screen brightness can be caused by a number of problems, one of which is a dirty screen. Serious reflective deterioration can take place within sixty days after installation if the screen cleanliness is not maintained.

To remove dust, use a soft, specially-designed screen brush. The brush should have a telescoping handle and you should be able to reach the entire screen. If your screen is very tall, you may need a ladder, or even scaffolding, but it is important to dust the ENTIRE screen.

Begin at the top of the screen and use long, even motions so that all areas are brushed. It is recommended that you dust your screen at least once per month. If it has been longer than that when you begin, dust the back of the screen first so that the built-up grime falls through the perforations. Then, thoroughly brush the front of the screen. Depending upon screen size, this procedure will take several hours, so allow plenty of time.

Only matte white screens may be "spot cleaned" with liquid. Using any type of cleanser—even water—on a "gain" screen is tantamount to putting turpentine on paint: You will remove the reflective coating. Matte white screens may be spotted with warm water and mild detergent. However, always remember that the screen surface has a third dimension. It is a soft vinyl that is vulnerable to tears and distortions. Don't press too hard into its surface.

REPAIRS When considering repairs to a torn screen, realize that although a screen may be "healed," it will never be the pristine surface it was when it was new and undamaged.

The most difficult repair is a surface scratch that has removed the reflective coating on a gain screen. Careful application of aluminum lacquer similar to the original coating or a pearlescent lacquer equal in brightness to the original can reduce the damage.

The repair will not return the screen to its original condition, but it can reduce its visibility.

Similarly, a tear in a vinyl screen can be repaired with one of the high quality clear vinyl adhesives available from hardware stores. Short strips of masking tape should be used on the back of the screen to pull the damaged areas together. If tape is used, make sure it is white on the adhesive side since this is side facing the audience.

A hair dryer can be used to soften the vinyl, making it more pliable, to help align torn edges.

PROTECTING YOUR SCREEN One factor to consider during the planning of a new theatre is the location of the heating and air conditioning ducts relevant to the screen.

Air blowing directly onto the screen should be avoided because vinyl is affected by temperature. Ducts should NOT be placed behind or just above the screen. If the screen is perforated, the moving air causes the screen to act as a large air filter, trapping dust and dirt in the perforations.

If high-powered air blowers are used to clean the auditoriums between showings and at the end of the evening, it is important to dust the screen at least every week.

Positioning curtains over the screen is desirable. If the screen is exposed only when film is being projected, the amount of surface dust allowed to accumulate from day to day is significantly reduced.

Sound

WHAT IS SOUND?

The perception of sound is caused by fluctuations in air pressure near the ears. There is no way to capture or record the fluctuations in their existing state of air pressures. Therefore, a microphone is used to convert fluctuating air pressures into electrical voltage. This electrical signal is amplified and sent to the recording system. That "record" may be played back, generating the electrical signals which are converted to sound waves by loud speakers.

For purposes of discussing theatre sound, there are two relevant steps in current sound technology: recording and reproduction. The higher the quality of both the recording and playback equipment, the closer the ear will experience the authentic original sound.

Optical sound processes use "light" in some form to record and reproduce sound. Some optical sound processes are photographic, using light-sensitive silver halide media to record a representation of an audio signal. Magnetic sound is neither optical or photographic. Digital sound uses digital signals on photographic sound recording systems.

SOUNDTRACKS

The soundtrack runs longitudinally on film and is adjacent to the image. The sound signal is encoded within it. Although professional audio was predominantly analog until the last few years, digital sound is gaining a firm hold on both consumer and theatrical markets. Optical, magnetic, and digital sound formats are used in today's theatrical release prints, although the advent of digital sound has all but eradicated magnetic usage.

OPTICAL optical soundtrack is photographically printed on the release prints, usually at the same time as the image. The optical track contains sections with varying widths and areas that register the volume and frequency of the sound recorded. These sections consist of one or more tracks which are narrow, jagged, black- and- white patterns along the film's edge. Reproducer components convert the transparent line of the optical soundtrack into voltage signals as "sound." The exciter lamp in the projector soundhead shines with a constant bright light. It is focused through a lens and an aperture as a narrow slit onto the soundtrack area.

NOTE: Red LED readers are moving into projection systems in place of exciter lamps. They effectively read the high-magenta soundtracks that are and will continue to replace silver tracks. All new projectors have these "red readers" and many theatres have retrofitted their existing equipment.

The quality of the sound lens is as important to sound reproduction as the projection lense is to image reproduction. Regular cleaning of the soundhead optics will help maintain the optimum level of sound quality. Use lens tissue and lens cleaner to clean all optical surfaces.

As the film moves, the lines of the soundtrack area allow a variable amount of light to pass through, as they get wider and narrower. A solar cell pickup creates a small altering voltage. This voltage is the sound which is then amplified and passed through the speakers. The solar cell is quite fragile. Clean it only with compressed air and be very careful not to damage it when cleaning sound optics.

The wider the soundtrack lines, the more voltage obtained from the solar cell and the louder the sound. The speed of soundtrack variation determines the frequency of the voltage or the pitch of the sound being produced.

Since the aperture is located in a different area of the projector that the soundhead, optically printed sound is placed approximately 21 frames ahead of the corresponding visual frame.

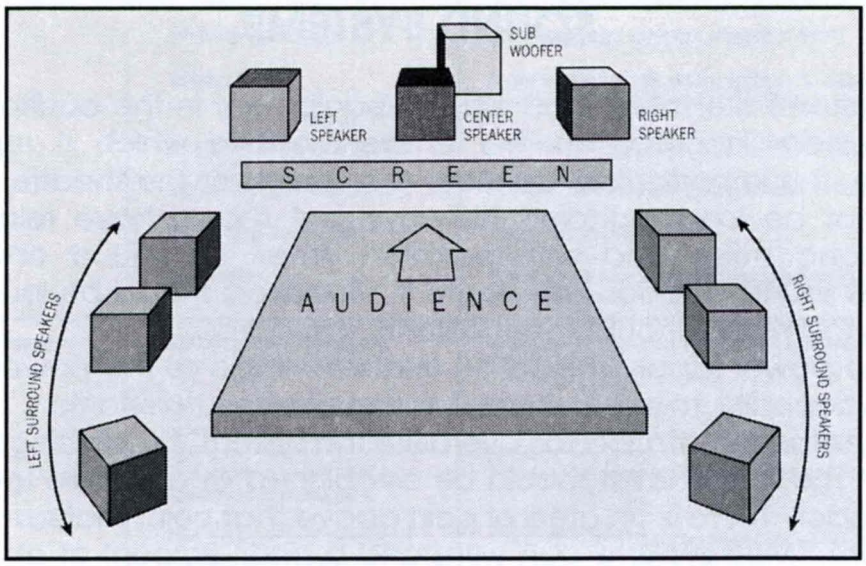
MAGNETIC Magnetic stereo sound was introduced to moviegoers in 1952. It consists of stripes of metallic oxide coated along the film's edges. The sound recorded on film is created by passing the tape over a magnetic head similar to an audio tape recorded. 70mm magnetic sound has six audio channels (home stereo typically has only two).

Sound is recovered on the magnetic strip from a playback head located in the magnetic penthouse above the main projector head. The magnetic head creates a small voltage proportional to the magnetism on the soundtrack. These voltages are then amplified, processed, and sent to the speakers as separate sound signals. All magnetic soundheads contain a sound stabilizer–a filter device to smooth the film motion as is passes over the pickup head—to prevent "wow" and "flutter."

Magnetic sound also has an offset between the picture frame being projected and the corresponding sound. This is about 23 frames. Loop size is critical to maintaining the proper offset so that picture and sound stay synchronized.

DIGITAL Digital sound is distortion–free, full–bandwidth audio with six separate channels. It is analogous in sound quality to a compact disc (CD). The six channels are separated to individual speakers: left, center, and right in front, split channels in the rear and/or along the sides, and subwoofer either in the back or next to the center speaker in front.

Three digital sound systems are found in theatres today: DTS, SDDS, and SRD. SDDS and SRD have penthouses through which the film must be

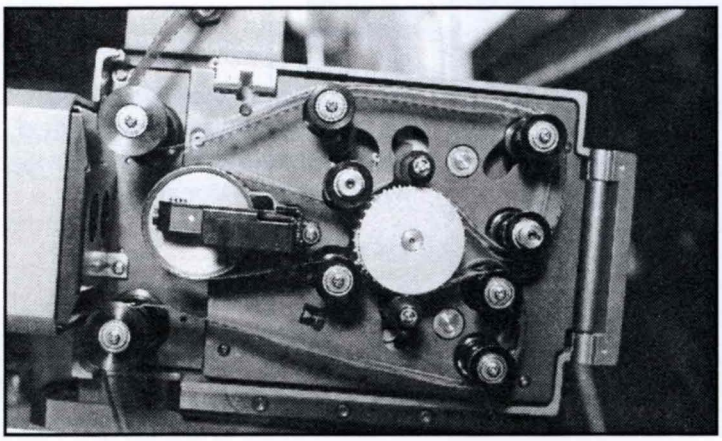


Speaker Placement

threaded for playback. These are installed atop the projector. Often, you will see both installed on top of a projector. DTS sound is on a separate disk that is synchronized with the sound processing unit for playback.

All three systems fall back to a traditional optical soundtrack encoded on the film. This provides a type of "failsafe" if the digital readers malfunction. The encoding process is essentially the same for all three systems. Digital sound encoding and reproduction reduce noise, providing a cleaner, more realistic sound. This is due to its on/off operation—i.e., there is either a strong sound signal or no sound at all. Digital processing converts sound to numeric code, stores the code, and converts it back into the original signal. Because of the precision with which the digits are converted to dialogue, music, or sound effects, problems with wow and flutter are eliminated. Digital sound is more durable than magnetic striping. Digital sound quality remains true after 1000 or more passes and cannot "flake" away.

Digital playback is similar to the reverse-scanning process used in some projectors for reproducing analog photographic sound. However, a single photocell is replaced with a solid-state scanner. When the film is projected, the digits encoded on the soundtrack are converted to analog signals using a digital reader.



Remember to thread the digital reader. You cannot reproduce Digitallly-Encoded tracks without it.

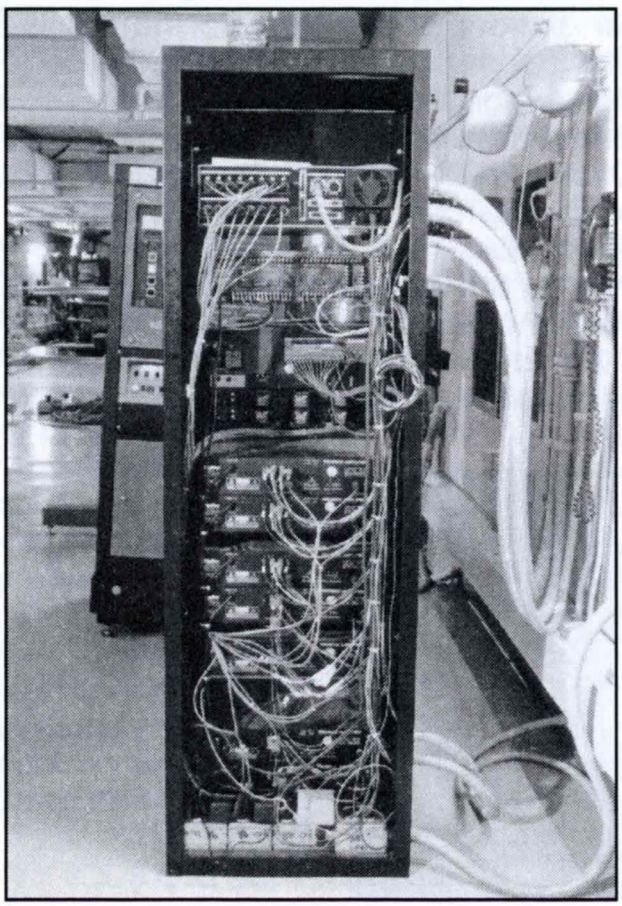
SOUND SYSTEMS

Sound systems are more than just the equipment in the auditorium. The sound system incorporates the environment in which it reproduces; therefore, it is important to consider the design of the theatre. Theatres should not be long, echoing hallways, but should have relatively low background noise and reverberation time. A sound environment recreates sound—it does not create it. Speakers should be loud enough to fill the room and should meet industry standards.

The power supply should be relatively large so the power amplifier has the capacity to reproduce the signal without distortion. However, sometimes the temptation to "overdrive the system" by blasting the sound is great. The house level should be established at a certain level by the master fader. There is an area of gain above that point that can damage the system. Most systems can withstand a small amount of abuse; some cann

Since many sound problems require technical service and equipment not found in most theatre booths, projectionists are not expected to be able to remedy any high-tech sound problem that may occur. In fact, unless a projectionist has an unusual amount of advanced technical training, it is better to avoid "tinkering" and call an expert.

In the interest of providing a projectionist with some suggestions for repairing minor sound problems, we offer the following charts:



Sound rack connections must be precise. Always work with a qualified sound technician when tuning your system.

SOUND

PROBLEM	PROBABLE CAUSE	REMEDY
No sound*	Amplifier malfunction	Make sure patch cords are plugged in firmly
	Speaker failure	If one speaker has no sound, problem is in auditorium; if all speakers malfunction, problem is likely in booth or sound-track
	Improperly threaded projector	Rethread film with sound-track facing correct way
	Individual circuit fuses blown	Replace. Spares should always be kept on hand
	Exciter lamp burned out	Install new exciter bulb
	Blown fuse	Replace with fuse of same amperage; fuse box located at rear of sound processor
Loss of high frequency sound or poor quality sound*	Scanning beam not properly focused on sound-track	Adjust fidelity focus until best sound is heard. Use SMPTE sound test films
	DIRT or oil on scanning beam optics	Clean with approved lens cleaner and lens tissue. Maintain regularly
Garbled sound	Inadequate loop size from aperture to scanning point	Increase recommended loop size to 19-21 frames
	Film not being held securely at scanning point. Lateral guideroller pressure on sound drum Insufficient	Check roller tension spring and adjust as necessary
	DIRT or oil on sound-track	Clean with film cleaner (ALWAYS wear lint-free gloves when handling film)
Hissing sound (train)	Scratches on sound-track	Cannot be repaired. Replace print
Crackling sound (frying eggs)*	Corroded socket connections, loose wiring, or loose terminal connections	Time for a service call and thorough checkup
	Cracked diaphragm in one or more speakers...either high or low frequency	Replace. As a temporary repair, rubber cement will reduce rattle
	Loose bracket in photocell	Tighten bracket to photocell
	Loose element in photocell	Replace damaged element
Extraneous noises	Extraneous light on photocell	Shield from light
	Radio transmissions	Shield wires to interrupt antenna effect
	Amplifier feedback	Ground and shield wires

DIGITAL SOUND

PROBLEM	PROBABLE CAUSE	REMEDY
No sound	Digital processor not on	Turn on all power
	Film not encoded for digital playback	Replace print
	Processor not In correct mode for digital playback	Set processor correctly for digital playback
	DTS disk loaded Incorrectly or wrong disk Inserted	Reload disk or replace with disk for movie being shown (IDTS sound disk will not operate unless matched with correct film
	Digital reader not threaded	Rethread film, to include digital reader
	Digital reader threaded incorrectly	Rethread digital reader
Poor sound quality	Improper tension	Rethread projector, ensuring proper tension on all rollers
		Rethread digital reader
	DIRT on lens for digital reader	Blow dirt off lens using compressed air (should be done daily)
	DTS and automation cables not connected to processor	Connect cable, making sure that DTS pin #1 Is properly oriented
Thumping noise when DTS is in optical mode	Soundhead picking up timecode	Adjust soundhead so it does not move laterally

* Many sound problems require technical service. If the suggested remedies do not solve the problem, consult a qualified sound technician

MAINTENANCE CHECKLIST FOR GOOD PROJECTION

This is a suggested checklist for your booth. We are sure that you will find other additions of your own. We hope that you will copy it and use it as a training device or just a reminder.

DAILY

Projector *(cleaning)*
- ❑ Gate and trap area
- ❑ Face and stand
- ❑ Components
- ❑ Rollers
- ❑ Intermittent oil (if applicable)
  - ❑ proper levels
  - ❑ foaming
- ❑ Components
  - ❑ dirt and / or wax
- ❑ Lenses and port glass

Platter
- ❑ Rollers
- ❑ Centerpiece
- ❑ Check speed

Sound
- ❑ Volume level
- ❑ Sound optics
- ❑ Speakers

Film Cleaning
- ❑ Particle Transfer Rollers *

WEEKLY

Projector
- ❑ Cleanliness of film path
  - ❑ Sound head and rollers
  - ❑ Sprockets
  - ❑ Sensing rollers/rings
- ❑ Film gate and pressure pads
- ❑ Lens and port glass

Platter
- ❑ Centerpiece
- ❑ Timing

Booth
- ❑ Work bench
- ❑ Floors
- ❑ Vents

Film Cleaning
- ❑ Web media cleaner and/or PTR's*

MONTHLY

Projectors
- ❑ Lubrication
  - ❑ intermittent
  - ❑ friction points
- ❑ Lenses
  - ❑ projector (all)
  - ❑ sound heads

Lamphouse (make sure power is off)
- ❑ Reflector
- ❑ Diffuser
- ❑ Airflow equipment

Booth
- ❑ Port glass
- ❑ General cleaning
  - ❑ platter (all stands, etc.)
  - ❑ tables, autowinds
  - ❑ humidifiers
  - ❑ floors, walls, filters, misc.

SEMI-ANNUALLY

Projector
- ❑ Drain and refill projector oil
- ❑ Sprockets
  - ❑ wear
  - ❑ excessive play
  - ❑ check intermittent
- ❑ Film gate
  - ❑ align film gate and trap
  - ❑ check guide rollers for binding and grooves
  - ❑ align intermittent tension shoe
  - ❑ intermittent shoe wear
  - ❑ connections and tightness
- ❑ Pad rollers
  - ❑ flat spots/grooves/binding

Platter/Make-Up-Table
- ❑ Drive motor brushes
- ❑ Variable transformers
- ❑ Inspect and lubricate bearings

Recommended Steps for Good Projection Before & During Every Screening:

- Make sure the gate and trap area are clean
- Check critical film path before and after starting projector
- Check loop sizes
- Is the lens clean?
- Make sure the correct lens is being used (scope or flat)
- Film print and film end secured on the platter
- Is the film running smoothly through projector and platter?
- Is the film in focus for both the trailers and the feature?
- Is sound system functioning properly?
- Is the correct sound system switched on (Dolby,DTS,SDDS, etc.)?
- Are the rollers moving smoothly?
- Is the film framed properly?
- Is the aperture plate properly aligned?
- Is the masking correct?
- Check sound levels in auditoriums

* Particle Transfer Rollers are safe and effective for cleaning film. If properly used, PTR's can be used to continuously clean your film print during every presentation. If you need information concerning PTR rollers, please contact your equipment supplier.

If you are not sure how to service any of the equipment listed – soundheads, sprockets, etc., don't despair. Call the manufacturer or consult the manual. There is no such thing as a stupid question when it comes to your safety or the care of your equipment.

Keep your hands away from moving parts and use extreme care and the proper precautions before working on electrical components or light sources.

Lexicon

A

ABRASION: Scratches on the film caused by dirt, improper handling, grit, emulsion pile-ups, and certain types of film damage such as torn perforations that can cause loops.

ACCORDION PLEATING: Film damage caused when film breaks in the projector and becomes folded in a restricted place.

ACETATE FILM: Film with a support layer containing cellulose triacetate.

ALTERNATING CURRENT (A. C.): Electrical supply that flows first in one direction and then the other .

AMBIENT LIGHT: Light from sources other than the projector (also called "stray light.") Likely sources are open doors, aisle lights, house lights, exit lights.

AMPERE (AMP): Electrical unit denoting the amount of current flowing in a circuit.

AMPLIFIER: An electronic device that increases the intensity of audio signals and provides sufficient power to drive speakers.

AMPLITUDE: The magnitude of air pressure fluctuations, perceived as loudness.

ANALOG SOUND: Sound waves converted into electrical form and amplified. The electrical signal replicates (or is "analogous to") the sound causing it. In projection, an exciter lamp is beamed onto the film soundtrack to activate the solar cell and cause the analog soundtrack to be reproduced.

ANAMORPHIC ("SCOPE"): The aspect ratio of screen image width to height that is expressed as 2:35:1.

ANGEL HAIR: Fine skivings or slivers of film emulsion, caused when the film edge rubs against a sharp edge or burr during projection. May also occur with excessive film/gate misalignment.

ANODE: The positive terminal or electrode in an electrical circuit. The positive electrode is a xenon bulb.

APERTURE: The rectangular opening in a metal plate that determines the size of the film image at the projector.

APERTURE PLATE: The metal plate containing the aperture .

ARC GAP: The distance between the anode and cathode electrodes in the xenon bulb.

ARC LAMP: A lamp whose light source consists of an open carbon arc or closed xenon arc. The light is generated in a gas ball between two electrodes.

ASPECT RATIO: The relationship of width to height of a projected image, such as 1.85:1 and 2.35:1.

ASPHERIC MIRROR: A mirror whose curvature has been designed to provide special optical characteristics and refinements that increase reflective efficiency, as used with xenon lamps.

AUTOMATION: Electronic or mechanical system which controls projection by responding to cues placed on encoded on the film.

B

BACKLASH: An irregular backward motion caused by worn gears in a projector. Symptoms include a chattering sound and poor image quality.

BASE: The transparent, flexible support—either triacetate or polyester—upon which photographic emulsions are coated.

BASS: The sound signal that plays through sub-woofers in stereo systems.

BIGSCREEN: Appellation for a screen that is "wall to wall," typically at least forty feet in width.

BLISTERING: The effect of excessive incident radiant energy on the film's emulsion. Such damage appears as tiny bubbles and renders the print useless (browning).

BLOOPING: The act of running a black felt-tip marker along both sides of the film in the soundtrack area prior to splicing it together. This action prevents an audible "pop" when the spliced film passes the soundhead.

BRAIN WRAP: During platter transport, the result of film becoming tightly wrapped around the centerpiece ("brain") of the platter in a clockwise direction. This typically occurs due to platter rotating too slowly, erratically, or not al all.

BREAKDOWN TABLE: A film-handling unit that is one component of a platter system. It is used to load and unload film to and from the platter. It is an independent system component, motorized, and able to be moved easily. It is also referred to as a "make-up table" (MUT).

BUCKLE: An unusual distortion caused by the loss of solvent moisture from the film edges during storage such that the perforated edges are actually shorter than the centerline of the film.

BUILD-UP: 1. The accumulation of emulsion particles on the fate trap rails or other areas of the film path; 2. The process of connecting the reels of film into one long reel for platter transport.

BURR: Physical damage to a sprocket tooth or other metal projector component causing it to protrude, buckle, or form a rough edge.

BUTT SPLICE: Film splice in which two precisely cut film ends are held together with splicing tape and the two ends do not overlap.

BUZZ TRACK: A test film that measures lateral deviation of the sound slit.

C

CANDELA: International unit of luminance measurement (one candela per meter = .02919 footlamberts).

CAPACITOR: An electrical device that temporarily stores energy.

CATHODE: The negative terminal or electrode of an electrical circuit; the negative electrode in a xenon bulb.

CEMENT SPLICE: Film splice made with solvent cement in which two cut ends of film overlap. Cement splices should never be used with polyester-based film. This type of splice, also known as a "glue splice," is mostly obsolete, since most splices are done with tape.

CENTERPIECE WRAP: See "brain wrap."

CHANGE-OVER: The act of changing from one projector to another while the movie is running, preferably without interrupting the continuity of onscreen action.

CHANGE-OVER CUE: A small circle scratched into the film in the top right-hand corner of several frames to signal the film-handler that the reel is about to end.

CHANNEL: A signal path of a sound system.

CINCH MARK: Short, longitudinal scratch on film, usually caused by one convolution of film sliding against another during rewinding.

CINEMASCOPE: The anamorphic system introduced by Twentieth Century Fox to project a widescreen image using an aspect ratio of 2.35:1. "Cinemascope" is shortened to "scope" to indicate any anamorphic projection format today.

CIRCUIT: 1. Term applied to motion picture exhibitors that have more than one theatre; 2. Closed path through which an electrical current may flow.

CIRCUIT BREAKER: A switch that automatically stops the flow of electrical current through an overloaded circuit.

CLATTER: Noise caused by excessive gate tension and/or insufficient film lubrication as film passes through the gate.

CLUSTER ROLLERS: Two or more rollers comprising a single unit, such as those used on a platter transport system.

COLOR SATURATION: Term used to describe the brilliance or purity of a color, particularly on a projected film image.

COLOR TEMPERATURE: Term that describes the gradations of "white light," from the red to the blue ends of the spectrum. Color temperature is expressed in Kelvin degrees, with the red end being lower, or cooler, and the blue end being higher, or warmer.

CONDUCTOR: A metal that is capable of passing electrical current.

CONTRAST: The difference between light and dark areas of a print.

CORE: Circular, plastic hub upon which film is wound for shipping.

CREASING: Longitudinal physical damage to film caused by improper threading or by cupping the film too tightly during inspection.

CROPPING: Eliminating a portion of the film frame at the image's edge(s). If a film is projected at an incorrect aspect ratio or with improper aperture plates, lenses, or masking, the image is said to be "cropped."

CROSS-ABRASION: Short scratches across the film width that occur when sections of the roll shift from side to side during shipment.

CROSSOVER: Electronic network that separates the amplifier audio output signal into frequency bands to match the speakers, such as woofers and tweeters.

CUES: In automated systems, cues are small strips of foil placed on the film's edge or a barcode on the film's base. For change-over systems, small circles in the upper right hand corner of successive frames serve as cues to assist the operator in maintaining continuity when changing from one projector to another during the movie.

CURL: Film distortion caused by humidity changes between the emulsion and base layers.

CURRENT: The magnitude or volume of an electrical flow, measured in amperes (amps).

CYAN: Blue-green color, the complement of red or the minus red subtractive used in the three-color process of film composition.

D

DAYLIGHT: The term for light comprised of sunlight and skylight—said to have a color temperature of approximately 6500 degrees Kelvin.

DECIBEL: The relative measure of sound intensity, tracked logarithmically. One decibel (dB) is considered to be the smallest unit detectable by the human ear.

DEPTH OF FIELD: The third dimension—distance of depth—between objects in a photographic field.

DEPTH OF FOCUS: The distance that film may be moved from a projection lens without degradation to the onscreen image.

DIAGONAL SCRATCHES: Slanted cross-scratches on film usually caused by the film riding over the edge of a roller flange. Also known as "traverse" or "hashmark" scratches.

DICHROIC: A type of coating that, when applied to glass, can produce a "cold mirror" for use in projector lamphouses that permits enhanced screen brightness without risk of radiant energy (heat) problems.

DIFFRACTION: The spreading of light as it passes through narrow slits. It is also diffracted when passing through a lens. The effects of this distortion on images is greater as the aperture becomes smaller.

DIGITAL SOUND: A type of sound which takes the original analog signal, converts it to a numeric code by assigning "bits" to each sample, and then converts the code back into analog sound for reproduction.

DIODE: Electronic component that passes current in a single direction. Diodes are used to change alternating current (AC) to direct current (DC) in xenon rectifiers.

DIRECT CURRENT (D.C.): Electrical supply that flows in only one direction.

DISHING: A condition which occurs when a reel of film is incorrectly wound (either too loose or too tight) that has slipped edgewise to form a concave/convex shape similar to a dish.

DISTORTION: Any difference between the original sound and the recorded/reproduced signal.

DOLBY: Trade name for audio systems that incorporate noise reduction and various stereo reproductions.

DOUBLE-SYSTEM SOUND: The recording of sound on tape and picture on film so that they may be synchronized during editing and playback.

DOWSER: A metal blade in the lamphouse used to eliminate light. It is used to protect either the shutter or the film from severe heat damage when they are not in motion.

DUBBING: The addition of sound (music, effects, or dialogue) to a visual presentation by means of a re-recording process. The resultant sound mix is transferred to or synchronized with the visual material to create the soundtrack.

DUPE: A duplicate made from either the master negative or positive.

DUSTING: The formation and accumulation of fine particles in the projector gate area.

DYNAMIC RANGE: The expression in decibels (dB) from the quietest to the loudest distortion-free sound signals.

E

EDGE NUMBERS: Sequential numbers printed along the film's edge outside the perforations to designate the footage.

EDGEWAVE: A condition that occurs when one or both edges of the film are longer than the center portion.

EDGEWAXING: A method of lubricating film with a paraffin wax solution applied to the emulsion side of the film at its edge.

ELECTRODES: Electrical terminals.

ELECTRON: Particle which carries an impulse in an electric current.

EMBOSSING: Film damage caused by repeated projection with a misaligned lamp or excessive lamp heat.

EMULSION: A light-sensitive material consisting of gelatin layer(s) containing silver halides and dyes to carry the filmed image.

ENDPLAY: Lateral movement of the starwheel shaft containing the intermittent sprocket. This is a principal cause of "weave."

ESTAR: Kodak trade name for polyester-based film.

EXCHANGE: Regional distribution facility set up to service theatres with films.

EXCITER LAMP: Bulb in the projector targeted to shine through the film soundtrack onto the photocell. The light-sensitive soundtrack is thereby stimulated to activate optical sound.

EXTENDED-LENGTH REELS (E. L. R.): Updated 2-reel film shipping configuration that minimizes film handling when film is built up for platter transport and projection. Each reel holds 6,000-8,000 feet of film.

F

FADER: Rheostat used to raise or lower sound volume.

FAILSAFE: Device that senses broken or severely damaged film and stops the projector. Typically, an alarm is sounded to alert projection staff.

FALL-OFF: Luminance reduction from screen center to edges.

FEATURE FILM: A main attraction, full-length (at least ninety minutes) theatrical movie.

FEED SPROCKET: A sprocket that is driven to pull film from a supply reel.

FILM: Thin, flexible, transparent ribbon with perforations at the edges that has sensitive layers capable of capturing and/or storing photographic images.

FILM GAUGE: The width of the film from side to side, measured in millimeters. 35 mm is the most common gauge for theatrical release.

FLAKING: The chipping of film emulsion caused by lack of lubrication. It usually appears as white dust in the gate area and embeds itself onto the film, causing a dirty, degraded image.

FLANGE: Rim of a roller used for guiding film during projection.

FLICKER: Rapid and continuous irregularity of screen luminance.

FLUTTER: Soft focus during projection due to instability of film position at projection aperture. This is often the result of excessive heat.

FOCAL LENGTH: The distance from the film to the optical center of the projection lens.

FOCUS: To adjust a lens so it produces the sharpest visual image possible.

FOOTLAMBERTS: Luminance measurement units used for measuring reflected screen light. One footlambert (ftL) = 3.425 candelas per square meter.

FORMAT: Description of the size and type of screen and sound images. For example, it delineates the width of the film, the aspect ratio, and type of encoded sound, among other specifications.

FRAME: An individual photographic image on film.

FRAME LINE: The separation between individual photographic images on film.

FRAMING: Aligning the film image in the projection gate aperture so the individual frame appears centered onscreen.

FREQUENCY: The number of air fluctuations per second, perceived as "pitch" or "tone." The rate at which electronic impulses or sound is repeated in a specified period of time is measured in "hertz." Bass tones have low frequencies while treble have high. The human auditory range is 20Hz to 20,000Hz.

FREQUENCY RESPONSE: The ability of equipment to transmit or reproduce all or part of the audio spectrum without distortion.

FUSE: Device that interrupts or disconnects an electrical current flow that exceeds the capacity of the wiring and/or equipment.

G

GAIN: An increase in intensity. For theatres, gain usually applies either to screen luminance (a "gain" of 2.0 on a screen provides approximately double the surface reflectance of a "matte" screen) or to audio amplification (an amplifier that doubles the strength of a signal has a "gain" of 2).

GATE: The projector assembly that holds the film at the aperture, rigid and perpendicular to the optical axis, so it may be projected.

GATE TENSION: Resistance of film movement produced by adjustable spring-loaded rails in the projector gate.

GENEVA MOVEMENT: The projection assembly that moves film through the gate and holds it steady during projection.

GLOVE: Lint-free hand covering used to facilitate film cleanliness.

GLUE SPLICE: 1. Synonymous with "cement splice"; 2. Splice made at the lab during processing of the film.

GRAIN: Minuscule particles that comprise film emulsion.

GREEN PRINT: Newly-processed film with soft emulsion, making it difficult to stabilize with vertical movement and focus.

GROOVED TOOTH: Tooth on intermittent sprocket that is worn at base of pull-down side. Replace sprocket wheel to avoid film damage.

GROUND: Electrical term referring to a conducting connection between electric equipment and the earth or some other conducting entity.

GUIDE RAILS: Vertical rails located on either side of the projector trap that restrict lateral movement of the film as it passes through the gate.

GUIDE ROLLER: Any roller with flanges that is used to direct the film or restrict its position as it moves through the projector.

H

HEAD: The beginning of a reel or strip of film.

HEAT FILTERS: Optical devices that absorb or reflect non-visible heat energy radiating from the light source before it reaches the film plane.

HERTZ (Hz): Cycles per second; international unit of frequency. One hertz is equal to one cycle per second.

HOLDBACK SPROCKET: Any sprocket that prevents the action of take-up from being transmitted to the sound-scanning point.

HOOKED TOOTH: A tooth on the intermittent sprocket that is so worn it looks like a hook. Immediate replacement of the sprocket is necessary to prevent film perforation damage.

HOT SPOT: Highly-concentrated light flux centered on the film image in the projector gate usually caused by improper xenon bulb alignment. A hot spot can result from either incorrect lamphouse-to-projector distance or mirror-to-lamp distance. Light in adjacent screen areas is usually too low and the film can actually be blistered at the "hot spot" site.

HUMIDITY: A term referring to the presence or absence of moisture in the air. Extremes in relative humidity can effect the physical characteristics of film by causing such damage as curl, buckle, edgewave, static, or swell.

I

IDLER ROLLER: Any undriven roller shoe sole function is to support the film or change its direction.

IGNITER: A device on a xenon lamphouse used to ignite the lamp.

INFRARED: Long wavelengths of light that heat the film during projection. It is invisible and radiated from the xenon bulb. It can be dissipated by using dichroic filters.

INSULATOR: Non-conductive material used to keep electrical current on its appropriate path.

INTEGRATED CIRCUIT: Connected group of circuit elements, such as resistors and transistors, on a single tiny chip of semiconductor material.

INTERMITTENT: The unit that moves the film through the gate, holding it in place long enough to be projected. The mechanical components of the "intermittent movement" include a rotating cam and pin that engage in a four-slotted star wheel.

INTERMITTENT SPROCKET: The sprocket that pulls the film through the gate and is part of the intermittent movement unit.

J

JUMP: Vertical unsteadiness of the image when projected onscreen.

K

KELVIN TEMPERATURE: Temperature scale used to measure heat and color intensity from a xenon bulb.

KEYSTONING: Geometric image distortion caused by the projected image striking the screen at an oblique angle (also known as vignetting).

KILOWATT: Electrical power equal to one thousand watts.

L

LAMPHOUSE: The light unit of the projector that contains the xenon bulb, appropriate optical components and operating controls.

LATERAL GUIDE ROLLER: Flanged roller that keeps the film from sideways movement.

LEADER: Clear film containing information regarding the feature film that is attached to the head of a reel; it is important to have enough leader attached to the head to thread the projection system.

LENS: Optical device designed to focus an image onscreen.

LONGITUDINAL SCRATCHES: Scratches that run the length of a section of film.

LOOPS: Small sections of slack film above and below the gate which enable intermittent motion.

LUMINANCE: The measured value of screen brightness, measured in footlamberts or candelas per square meter or square foot.

LUX: Metric measure of illumination equal to approximately ten footlamberts (1 lux = 10.764 ftL).

M

MAGAZINE: Enclosed container on the projector that holds a film for projection and take-up.

MAGENTA: Color name for the minus-green subtractive primarily used in the three-color process; sometimes described as "blue-red."

MAGNETIC HEAD CLUSTER: Component in 70mm magnetic penthouse that contains six heads used to play back six magnetic tracks on a print. When the projector is designed to playback either 70mm or 35mm, the cluster contains four additional heads in the center to play back four tracks on 35mm (Magnetic sound and its components are mostly outdated today because of the advent and success of digital sound).

MAGNETIC SOUND: Sound derived from an electrical audio signal. The film carries magnetic stripes if it is applicated with magnetic sound.

MAKE-UP TABLE: Abbreviated as "MUT," this film-handling component of the platter system is used to assemble the shipping reels into one large film roll and uninterrupted platter projection.

MARRIED PRINT: Film print that includes both picture and sound.

MASKING: Flat black material bordering the screen that provides the projected image with a sharp edge.

MATTE WHITE SCREEN: Screen surface with no reflective properties. It is most often used in extremely wide-angle viewing configurations because of its evenness of illumination.

METHYL CHLOROFORM: Nonflammable, moderately-toxic solvent sometimes used for film cleaning and lubrication.

MIRROR: Optical device designed to focus or reflect light from the lamphouse to the film plane in the projector.

MOTORBOATING: The sound heard when film sprockets are lapping over the sound scanning point.

N

NEGATIVE: Film in which the light and dark images are reversed. As in still photography, the positive picture is created from the negative film strip.

NITRATE: Flammable film base not used in the last forty years. Some archive film still exists on nitrate-based stock. It is recommended that this be transferred to safety film such as acetate or polyester.

NOISE: Sound present in audio playback that was not part of original recording.

NOISE REDUCTION: The process of reducing unwanted background audio system noise by the use of special electronic circuitry during playback.

NOTCHING: The film-handling practice of making a "V" cut to remove damaged perforations. This is not a recommended practice, since further damage may ensue. Proper splicing should be done instead.

O

OHM: Unit of electrical resistance.

OPEN CIRCUIT: Incomplete electrical circuit, typically caused by either an open switch or broken wire.

OPTICAL SOUND: Audio system in which soundtrack applicated onto the film is scanned by a horizontal slit beam of light that modulates a solar cell or photocell. This sound is then amplified and routed to speakers.

OUT-OF-FRAME: A condition that exists when the projected image is not vertically centered on the screen, causing a portion of the adjacent frame to be visible near the top or bottom of the screen.

OVERLAP SPLICE: Splice in which one end of film overlaps the other.

P

PAD ROLLER: Roller designed to hold the film against a sprocket.

PARTICLE TRANSFER ROLLER: Known as "PTR," this type of roller is mounted in clusters of two or more, replacing feed rollers. PTR's are made of inert polyurethane that is slightly tacky and used for continuously cleaning film as it is projected.

PEARLESCENT: Screen coating so named because of its similarity to "mother of pearl" coloration. It is applied to a screen surface to provide "gain" or reflectivity equal to approximately 2.0:1.

PENTHOUSE: Name given to a soundhead mounted atop a projector; can apply to either magnetic or digital soundheads.

PERFORATIONS: The symmetrical precision holes on either side of the film that engage the sprocket teeth to drive the film through the projector.

PHOTOCELL: Electronic valve that adapts modulated light from the soundtrack into electrical impulses that can be amplified to drive speakers.

PHOTOMETER: An electronic optic device to measure screen brightness.

PLATTER: Film transport equipment consisting of at least three large, horizontal disks, each capable of holding 20,000-30,000 feet of film.

POLYESTER: Film base exhibiting superior strength and tear characteristics that is becoming the base of choice for theatrical projection. Kodak's trade name is ESTAR.

PORT GLASS: Window in the projection booth wall through which the light from the projector shines so the film may be projected to the screen.

POWER SUPPLY: Source of electrical current that provides direct current (DC) to drive rectifiers, exciter lamps, monitors, processors, and other pieces of ancillary equipment.

PREAMPLIFIER: Electronic equipment used for boosting weak signal voltage to usable amplifier levels.

PROJECTION ANGLE: Angle formed by the central axis of the projection beam and the projection booth floor, or other horizontal reference.

PROUD EDGES: One or two convolutions of film that protrude above the smooth surface of a firmly-wound reel of film and are susceptible to damage.

PULLDOWN: Action of the intermittent sprocket on the film in the gate.

Q

QUARTZ: Material similar to glass that is capable of withstanding greater radiant energy than glass without breaking. It is used as the envelope for xenon bulbs and certain heat-resistant filters.

R

RECTIFIER: Electronic device that converts AC current into DC necessary for operating xenon and exciter bulbs.

REEL: Spool or circular frame with a core used to hold film.

REEL TENSION: Resistance applied to the projector reel spindle to provide slack-free supply and wind up of the film.

REFLECTANCE: Brightness emanating from a surface, such as a screen.

REFLECTOR: Any surface that casts back (reflects) light. The lamphouse mirror is generally called the reflector, although it is appropriate to refer to the screen as a type of reflector as well.

REFRACTION: The change of direction (deflection) or a light ray or energy wave as it passes from one medium to another, i.e., the media of air and glass.

RELAY: An electronically-operated switch used in automation.

RELEASE PRINT: Any of the numerous duplicate prints of a feature film used for theatrical exhibition.

RESISTOR: Component of an electrical circuit that opposes current flow. It is measured in ohms.

RESOLUTION: Usually expressed as "lines per inch," the higher the line resolution, the more finely-graded and seamless the film image when projected.

RETICULATION: Formation of a coarse, cracked surface on the emulsion of a film, appearing as wrinkles.

REWIND: Automatic console or set of bench-mounted spindles used to make up film for platter loading.

REWINDING: Process of winding film from take-up reel to supply reel so that the head of the reel is on the outside.

ROPING: Continuous sprocket tooth indentation along the length of the film. It is usually caused by a poor splice that forces the film to ride off the sprocket tooth during projection.

RP-40: SMPTE test film used to evaluate jump, weave, line resolution, and proper projector alignment when film is being projected.

S

SAFETY FILM: A film with a non-flammable base, such as acetate and polyester. Nitrate film was highly flammable and is NOT safety film.

SCOPE: Commonly-used shortened term for "anamorphic" or "Cinemascope" format.

SCRATCHES: Abrasions of the film surface so that lines or marks permanent damage the film, often scraping off the emulsion all the way to the base layer.

SCREEN: Reflective sheet at front of auditorium onto which film is projected.

SEMI-AUTOMATED: Projection system in which some functions, such as change-over or start and stop, are controlled electronically.

SENSOR: A device used to activate an electronic circuit or mechanical system to start, stop, or alter a normal operating procedure.

SHIPPING REEL: Reel whose primary purpose is to hold mounted film while it is being moved between exchange and theatre.

SHRINKAGE: Film damage that occurs due to moisture loss caused by solvents, heat, lack of humidity, or age of film.

SHUTTER: Two-bladed rotating device used to interrupt the light source while the film is being pulled down into the gate. One blade masks the pulldown while the other interrupts the light. Improper shutter timing can cause flicker and travel ghosting.

SIGNAL-TO-NOISE RATIO: Measured in dB, it is the ratio between a specified signal level and the noise level in the absence of a signal. The greater the signal-to-noise ratio, the less the unwanted noise will be heard.

SINGING SPROCKETS: Noise caused by film under excessive tension being pulled from sprocket teeth.

SKIVINGS: Fine, thread-like particles found near the fate and cuased by physical abrasion against a burr in the film path. These can also result in a type of "shedding" of a print that is not completely dry during its initial projections.

SMPTE: Acronym for the Society of Motion Picture and Television Engineers. This group sets the majority of the standards for motion picture projection, principally in the U. S. and Canada, but recognized internationally as well.

SOUND DRUM: Cylinder that holds the film steady while the soundtrack is being scanned.

SOUNDHEAD: Projector component which contains all sound-reading elements, whether optical, magnetic, or digital.

SOUNDTRACK: Lengthwise track in which sound is encoded that is adjacent to the image on the film. There can be more than one type of soundtrack application on any given feature film.

SPLICE: Method by which two separate lengths of film are united so that they function as a single film strip when passing through a projector. Splicing with tape on both sides of the film is the most common and also the recommend splicing procedure for theatrical release prints.

SPLICER: Device for making splices, usually having a spot for a tape roll.

SPLICING TAPE: Special adhesive tape used for uniting two ends of film that is heat resistant and generally transparent.

SPOKING: Film distortion caused by loose winding that permits the film to curl.

SPROCKET: Rotating metal wheel containing teeth that hold perforated motion picture film for purposes of transporting during projection.

STATIC: Electrostatic charge on non-conductive materials. If film has a static charge, it may be dissipated by spraying nearby surfaces (NOT the film itself) with anti-stat spray and raising the relative humidity in the projection booth.

STEREOPHONIC: Sound recording and reproduction involving multiple channels to simulate actual dimensional sound experience.

STRAY LIGHT: All non-image-producing light ("ambient light") intruding in the darkened environment of the theatre.

SUBWOOFER: Speaker used to reproduce very low sound frequencies.

SURROUND CHANNEL: Typically an audio channel with "blended" rather than distinct stereo tracks, it provides depth and atmospheric realism to a theatrical stereo application.

SWELL: An increase in film dimensions caused by moisture absorption during processing or storage and under high humidity conditions.

SYNCHRONIZATION: Picture and sound relationship in a motion picture film; said to be "in sync" when picture precisely coincides with the appropriate sound.

T

TAIL: The end of the film that follows the last image frame.

TAKE-UP REEL: The reel or platter onto which the projected film is wound.

TAPE SPLICE: Film splice using special adhesive tape applied to both sides of the film.

TENSION: Resistance to linear motion of film caused by restraining forces such as pads, drive sprockets, take-up drive motors, spring-loaded guide rails, and so forth.

TENSION PADS: Spring-loaded pads installed in the gate component of the projector gate assembly. Pad pressure is usually adjustable and should be set tight enough to produce a steady image, but loose enough to avoid clatter noise at the intermittent.

THREADING: Placing the film in the projector gate and along the sprockets so that it may be projected.

THROW: The distance from the projection aperture to the center of the screen.

TIMING: Adjustment of the rotating shutter so that the screen image does not show any vertical movement from the pulldown cycle or ghost image in adjacent areas of high contrast.

TRAILER: Short piece of film (usually less than three minutes) attached to the head of the feature film designed to advertise a product, the theatre circuit, or an upcoming movie.

TRAP: The fixed component of the gate assembly.

TRAVEL GHOST: Light area adjacent to the screen image caused when the shutter is improperly timed with the intermittent pulldown.

TURRET: Revolving unit holding more than one lens that may be motorized and tied to the automation system to enable lens changes as required.

TWEETER: Speaker which produces the higher frequencies in the audio spectrum.

U

ULTRASONIC CLEANER: Device to transmit ultrasonic energy to a suitable cleaning fluid which removes embedded dirt on film.

ULTRAVIOLET: Invisible energy in the light spectrum which is created by xenon bulbs, but removed by mirrors and lenses during projection.

UNSTEADINESS: An objectionable amount of motion in the screen image, either horizontal or vertical. Horizontal movement is known as "weave." Vertical movement is called "jump."

V

VARIABLE AREA SOUNDTRACK: Photographic area on an optical soundtrack where the light modulation is effected by variations in track width.

VENTING: Providing adequate air motion to effectively cool the inside of the lamphouse.

VIGNETTING: Dark sides and corners of a projected image onscreen due to the focal length of the lens being too long so that some of the light rays are masked.

VOLT: Unit of electrical pressure.

W

WATER COOLED: Refers to a method of decreasing gate temperature to tone down the amount of heat on the film.

WATT: Unit of electrical power. Watts = amps x volts.

WEAVE: Horizontal motion in the projected screen image.

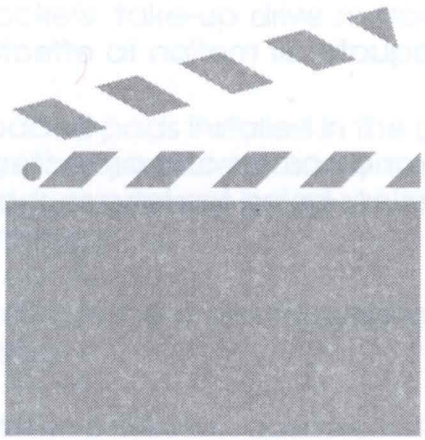
WIDESCREEN: General term used to describe a screen image that is wider than a 1.66:1 aspect ratio.

WOOFER: Speaker which produces the lower frequencies of the audio spectrum.

WORKPRINT: During post-production, a rough-cut print of the final movie is used by the editors to assemble the finished product. Typically, it is dirty and scratched due to the high degree of handling. It is not intended to be seen by a final audience, but is used as part of working toward the "final cut" of the creative product.

X

XENON BULB: Quartz envelope containing two electrodes that produce an arc in a high-pressure xenon gas, used to illuminate the film during projection.

Y

YELLOW: The minus-blue subtractive layer of color film.